THE ASTRO LINE SERIES

GEMINI 4000 INSTRUCTION MANUAL

INTRODUCTION

The Gemini 4100 and 4200 are both units in a multi-purpose series of industrial control units that are field-programmable to solve multiple applications. This series, known as the Astro-Line family of products, is built around the concept that the end user has the capability to program different personalities and functions into the unit in order to adapt to different indication and control requirements.

The Gemini, which you have purchased, has the same high quality workmanship and advanced technological capabilities that have made Red Lion Controls the leader in today's industrial market.

Red Lion Controls has a complete line of industrial indication and control equipment, and we look forward to being of service to you now and in the future.

CE

CAUTION: Risk of Danger.
Read complete instructions prior to installation and operation of the unit.

CAUTION: Risk of electric shock.

TABLE OF CONTENTS

GENERAL DESCRIPTION

The Gemini 4000 series (4100 & 4200) instruments are two input microprocessor based dual function counter/rate or dual counter instruments. The 6-digit display features 0.56" high LEDs with negative sign, overflow and displayed value indicators (A & B) located to the left of the display. When programmed as a counter/rate instrument, the A indicator will be on when the rate is displayed and the B indicator will be on when the count is being displayed. Pushing the "+/-" button toggles the display between the counter and rate or the two counters depending on the personality selected.

The Gemini 4000 series consists of two basic units, a single preset version, the Gemini 4100, and a two preset version, the Gemini 4200. Each basic unit is also available in 115/230 VAC versions, with or without Serial communications and a relay board. The 20 mA current loop option (serial communications) makes possible remote or computerized monitoring or control of the Count, Presets and Scale Factors.

Flexibility and usefulness are insured through user programmability. With simple front panel keystrokes and rear panel switch settings, any one of a number of configurations can be selected. Once the selection is made, all or part of the keyboard can be disabled to protect the settings and guarantee that no unwanted changes can occur during the measurements.

Each time the power is turned off, the unit automatically saves the settings and data in its special no power memory. When power is restored, the Gemini sets itself back to the operational modes and restores the data it had at power down. The "no power" E^2PROM's life expectancy is at least 100,000 cycles of power being applied to and removed from the unit.

Whenever the power comes on, the Gemini performs a series of internal diagnostics to verify the integrity of the stored data. There is also a self-test mode and a "watchdog" timer to help prevent processor lockup.

The Gemini 4000 series counters can accept bi-directional, uni-directional, or quadrature signals. They also have the capability to double or quadruple (Quadrature x4) the resolution of the incoming count signal. A separate input mode is available to make the counter/rate or dual counters completely independent of each other.

One input provides the signal for rate or a counter and the other input provides the signal for a counter. An anti-coincidence add/subtract mode is also provided to obtain a difference between two input signals.

Each channel features separate scaling and decimal point placement for readout in different units or at different resolutions.

A Counter Load feature enables the operator to modify the count value under circumstances that occur when flawed material has been counted and it is necessary to adjust the count value accordingly. The Counter Load feature can be "locked out" in applications where it is not required.

The Rate Indicator portion uses a time interval method (1/tau) to calculate the rate value. This method enables high resolution at all rates. The unit counts input pulses and after a programmable minimum update time has occurred, it waits until the next edge occurs, takes the elapsed time and number of edges, and calculates the rate value. At slower rates, averaging can be accomplished by programming the "Rate Minimum Update Time" (0.5 sec. to 16 sec.) for the desired response. Extensive scaling capabilities allow practically any desired reading at very slow count rates.

For maximum flexibility, the Gemini's output(s) can be assigned to either the rate or count channels or one to each. When in dual counter mode, the output(s) can be assigned to the Counter B channel. For the Gemini 4200, one can be assigned to Counter A and the other to Counter B.

The relay(s) are mounted on a plug-in board which makes it easy to field upgrade your Gemini. The contacts are rated for 240 VAC or 28 VDC at 5 amps.

The construction of the Gemini features a metal, die cast bezel for maximum durability with high quality appearance. The sealed front panel meets NEMA 4/IP65 specifications for washdown and/or dust, when properly installed. Electrical connections are made with removable, plug-in terminal strips at the rear of the unit. Clamp-type pressure plate terminals accept stripped #14 AWG wire without lugs.

SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Do not use this unit to directly command motors, valves, or other actuators not equipped with safeguards. To do so, can be potentially harmful to persons or equipment in the event of a fault to the unit.

PROGRAMMING THE GEMINI

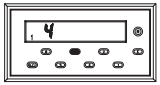
When your Gemini arrives from the factory, it has already been programmed to function as a counter and rate indicator. It is programmed with the factory settings listed in the "Initial Factory Configuration" section. If it is required to have the unit operate as two counters, the Unit Personality function code can be changed to do so.

The personality, functions, and modes are accessed by pressing the appropriate keys. A function is defined by a two-digit code which appears on the left side of the display. The mode of that function is shown as a one-digit code on the right side of the display. At times there will be a "-" sign modifier to the left of the mode.

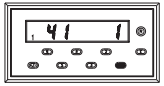
Data for the Presets, Scale Factors, Timed Output Values, and Counter Load Values are entered differently. Each digit key controls the digit on the display directly above it. Changing the digits can be done by repeatedly pressing the key beneath the digit position you wish to change or by holding the key down. As you hold it down, or repetitively press it, the value of that digit will change cyclically, counting up to 9, then to 0, and then up again. The 6 numbered keys correspond to the six digits, and the "+/-" key corresponds to polarity.

PROGRAMMING THE PERSONALITY

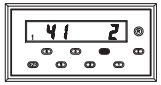
Entering function and mode is easily accomplished by pressing the appropriate digit key. For the personality function, you would enter 41 by pressing the front panel keys 4 and 1.



The digits on the left side of the display show the function code; the digits on the right side show the current programmed mode.

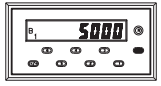


A mode selection is made by entering a new number. On some of the entries, you have the option of a plus "+" or minus "-" sign. In the cases where a "+" sign is required, no sign will be displayed. If you do enter a "-" sign (using the "+/-" key), a minus sign will be displayed in front of the appropriate digit.



Pressing the "E" key finalizes the change. The display will now show the count or rate value immediately.

If you do not press the "E" key, the change will not be recorded. The display will remain in the programming mode for 15 seconds, and then return to normal operating mode using the old functional mode setting.



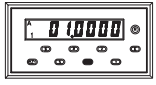
Whenever the Unit Personality is changed, the factory settings will automatically be loaded into the unit. The factory settings can also be programmed into the unit by calling up the Unit Personality, putting a "-" in front of the mode by pushing the "+/-" button, and entering it.

Refer to the "Initial Factory Configuration" section for more details.

PROGRAMMING THE PRESET, SCALE FACTORS, TIMED OUTPUTS & COUNTER LOAD VALUES

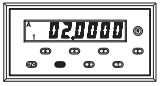
The Presets and Scale Factor Values are commonly reprogrammed on a daily basis. As such, single keystroke access has been provided.

The Gemini has two Scale Factors, one for display A (Counter A or Rate A), and one for display B (Counter B). Pressing the "3" key will call up the Scale Factor for the current display (Rate A/Counter A, or Counter B).

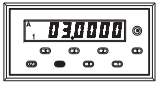


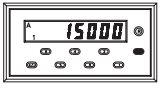
To call up the "other" Scale Factor, the "+/-" key is first pushed to change the display to the "other" value, then the "3" key is pushed to display the Scale Factor for that value.

PROGRAMMING THE PRESET, SCALE FACTORS, TIMED OUTPUTS & COUNTER LOAD VALUES (Cont'd)



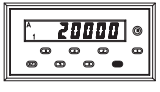
Once the Scale Factor is displayed, changing the digits can be accomplished by repeatedly pressing the key beneath the digit position you wish to change or by holding the key down, allowing the digit to cycle.



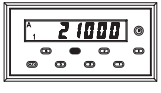


The new value will be entered when the "E" key is pressed.

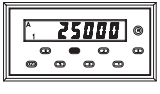
The internal count value is multiplied by the Scale Factor Value, which changes the displayed value accordingly. It is important to note that the precision of an application cannot be improved by using a Scale Factor greater than one. To accomplish greater precision, more pulse information must be generated per measuring unit. For example, if 5 pulses are being received per foot of material, the precision of 10th of feet cannot be attained by simply programming a Scale Factor of 2.0000, even though the display is reading in tenths. In this case, the display will increment by two for each count input. Thus, if an odd Preset Value is entered, such as 6.7 ft., the Gemini will alter the Preset display to read in even tenths of feet.

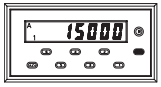


To display the Preset 1 Value the "1" key is pushed.



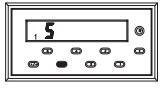
To change the value, the digits can be cycled through in the same manner as discussed for the Scale Factor. The preset values can range from -999999 to +999999.



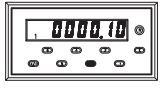


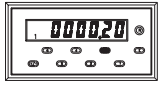
The new value will be entered when the "E" key is pressed.

The Scale Factor Value will have a direct effect on the preset being entered (if assigned to the counter). For Scale Factors greater than one, the preset value should be an integer multiple of the Scale Factor. If it is not, the Gemini will automatically adjust the preset value up or down to force it to be evenly divisible by the Scale Factor.

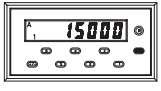


The Timed Output 1 or 2 Value is changed by entering a two-digit function code. After the code is entered, the display will show the present Timed Output Value in seconds with two decimal place resolution. The Timed Output Values can be set from .01 to 599.99 seconds.





To change the Timed Output 1 Value, enter function code 53 and enter the new value by holding down or repeatedly pressing the key below the digit position you wish to change. The new value will be entered when the "E" key is pressed. The display will immediately return to the count value.

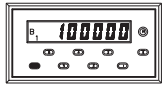


Note: A Timed Output Value of zero cannot be programmed into the Gemini. If a value of 0 is entered into the display and the "E" key is pressed, the unit will remain in data entry mode. If a new value is not entered, it will time out and the unit will continue to use its previous setting.

As with the other functions, you must press "E" to record the changes. For the data entry modes, if you do not press the "E" key, a time out of 5 seconds occurs, and the display returns to operating mode without any changes to the value. The only time any change will occur is when the "E" key is pressed.

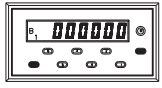
It is possible to change the counter values of the Gemini. This feature can be enabled or disabled by the programming of the “Operator Accessible Functions Modes”, function code 66. The “Counter Load Value” is not stored when the unit is powered down. When the unit is powered up, the Counter Load values for both counters (if Dual counter personality) are reset to zero. Once changed, the values will be held until the unit is again powered down.

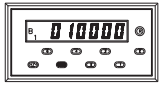
To access the Counter Load value for the desired counter; first, press the “+/-” key, if necessary, so that the display is indicating the counter value which is to be changed.



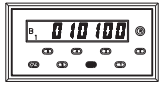
Secondly, press the “E” key and while holding it down, press the “+/-” key.

The Gemini will now display the displayed Counter Load value. (It will be zero, unless the value had been changed since the unit was powered up.)



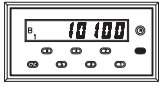


To change the value, press the key under the digit to be changed as explained previously for the Preset.



To load the value into the counter, press the “E” key.

The display will flash momentarily and will display the counter with the new value.



INITIAL FACTORY CONFIGURATION

Keys struck	Display	Description
4,1	41 1	Personality selected as COUNTER/RATE
4,2	42 3	Reset Rate (A) Output(s) & Counter (B)
4,3	43 1	Count with Inhibit
4,4	44 1	Single edge counting (B)
4,5	45 1	Counter B Scale multiplier of 1.0
4,6	46 1	Counter B leading zero blanking and no decimal point
5,1	51 2	Outputs 1 & 2 assigned to Counter (B)
5,2	52 3	Output 1 terminates at Reset, Normal Phase
5,3	0000.10	Timed Output 1 Value of 0.1 Sec
5,4	54 3	Output 2 terminates at Reset, Normal Phase
5,5	0000.10	Timed Output 2 Value of 0.1 Sec
5,6	56 1	Counter (B), manual reset to zero
6,1	61 4	No Rate (A) right hand dummy zeros
6,2	62 1	Rate per Second
6,3	63 1	Rate (A) 0.5 Sec Minimum Update Time
6,4	64 4	Rate (A) Scale multiplier of 1
6,5	65 1	Rate (A) leading zero blanking, no decimal point
6,6	66 1	No functions except Reset enabled
3	01.0000	Scale Factor A (Rate) set to 1.0000
3	01.0000	Scale Factor B (Counter) set to 1.0000
1	000500	Preset 1 set to 500
2	001000	Preset 2 set to 1000

*DUAL COUNTER FACTORY SETTINGS**

Keys struck	Display	Description
4,1	41 2	Personality selected as DUAL COUNTER
4,2	42 3	Reset Counters A & B
4,3	43 1	Count with Inhibit
4,4	44 1	Single edge counting (A & B)
4,5	45 1	Counter B Scale multiplier of 1.0
4,6	46 1	Counter B leading zero blanking and no decimal point
5,1	51 2	Outputs 1 & 2 assigned to Counter B
5,2	52 3	Output 1 terminates at Reset, Normal Phase.
5,3	0000.10	Timed Output 1 Value of 0.1 Sec
5,4	54 3	Output 2 terminates at Reset, Normal Phase.
5,5	0000.10	Timed Output 2 Value of 0.1 Sec
5,6	56 1	Counter B, manual reset to zero
6,1	61 1	Counter A, manual reset to zero
6,4	64 1	Counter A scale multiplier of 1
6,5	65 1	Counter A leading zero blanking, no decimal point
6,6	66 1	No functions except Reset enabled
3	01.0000	Scale Factor A set to 1.0000
3	01.0000	Scale Factor B set to 1.0000
1	000500	Preset 1 set to 500
2	001000	Preset 2 set to 1000

* If [41 1] is changed to [41 2], then the factory settings are as shown.

OPERATOR ACCESSIBLE FUNCTIONS WITH PROGRAMMING DISABLED

(For details on keyboard entry, see preceding section)

One of the important features of the Gemini is the ability to disable programming. With this ability, accidental bumping of the keys or tampering by unauthorized personnel can be prevented. However, it may be necessary to allow reset and certain programming functions, such as Preset and Scale Factor Values, to be changed in daily operation. The Gemini, through the use of the "Operator Accessible Functions" Modes can enable these functions even when the "PGM. DIS." (Program Disable) terminal is connected to "COMMON".

The "Operator Accessible Functions" modes are programmed by entering a two-digit function code (66) and the desired mode. Unlike other function codes, the mode does not take effect immediately. The "PGM. DIS." terminal must be connected to "COMMON" in order for the Gemini to disable programming and operate as per the mode programmed.

There are six basic "Operator Accessible Functions" Modes available. These modes enable the following functions.

1. **NO FUNCTIONS EXCEPT RESET ENABLED -** In this mode, manual reset is enabled, but none of the programming functions can be changed. However, the functions can be interrogated.
2. **PRESET PROGRAMMING AND RESET ENABLED -** The entire front panel is disabled with the exceptions of Preset programmability and manual reset. All functions can be interrogated.
3. **SCALE FACTOR PROGRAMMING AND RESET ENABLED -** The entire front panel is disabled with the exceptions of Scale Factor programmability and manual reset. All functions can be interrogated.
4. **SCALE FACTOR AND PRESET PROGRAMMING, AND RESET ENABLED -** The entire front panel is disabled with the exceptions of Scale Factor and Preset programmability, and manual reset. All functions can be interrogated.
5. **PRESET AND COUNTER LOAD PROGRAMMING, AND RESET ENABLED -** The entire front panel is disabled with the exceptions of Preset and Counter Load programmability. All functions can be interrogated.
6. **PRESET, SCALE FACTOR AND COUNTER LOAD PROGRAMMING, AND RESET ENABLED -** The entire front panel is disabled with the exceptions of Preset, Scale Factor and Counter Load programmability. All functions can be interrogated.

All of these modes can be modified with the addition of a "-" sign. The minus sign disables the manual reset, at the front panel and the remote reset (RST., not RST.A) terminal, at the rear of the unit.

There is also a rear panel DIP switch which permits disabling of the front panel reset button. This is independent of the rear terminal remote reset, and can be used in conjunction with any front panel disable mode. The combination of a manual and remote reset inputs provides a high level of security without sacrificing flexibility.

DIAGNOSTICS, SELF-TEST, & "WATCHDOG" TIMER

The security of the Gemini is further enhanced by its self-test diagnostic and "watchdog" timer capabilities.

The diagnostics are concerned with the special, no power memory of the Gemini. Whenever the power is turned off, all pertinent function settings and measurements (except the Counter Load values) are automatically saved. When power is restored, the functions and data are re-instated. This allows you to program the unit once and not have to re-program it until you wish to use it in another mode.

When the function codes and data are saved, computations are made with these values. The result of these computations is stored in the memory to serve as a check against possible error. On power up the same computations are repeated on the stored data. If the results do not agree with the stored results, a "P" will appear on the left side of the display. If this occurs, refer to the "Troubleshooting Guide" for directions.

DIAGNOSTICS, SELF-TEST, & "WATCHDOG" TIMER [Cont'd]

Another error indicator is the "watchdog" timer. In order to insure the software is functioning properly, the program constantly monitors itself. If the proper sequence and timing of internal events does not occur, an "E" will appear on the left side of the display. If this occurs, refer to the "Troubleshooting Guide" for directions.

The final type of built-in error checking is the front panel initiated self-test. It can be performed at any time, even when the Gemini is running. It will not interfere with the accumulation of counts or control functions. A function code of "6", "+/-" starts the test. At this time, whatever was displayed will disappear and be replaced by a string of decimal points and the overflow indicator. Then the display will show a string of 9's, then 8's etc., until a string of 0's are shown. The self-test will then turn off the overflow indicator and activate the minus "-" sign. Then the unit shows an interlace pattern of -010101, then -212121, followed by 232323 etc., until -898989 is reached. At this time the outputs can be tested by pressing the "1" or "2" key. (The program disable terminal must be disconnected in order to allow activation of the outputs. Also, when testing the output, use caution, so as not to cause any undesirable or hazardous conditions in the system.) An automatic exit will take place after six seconds or immediately if the Program Disable terminal is connected to common. Normal length of display time for each of the patterns is approximately 0.5 sec. Rapidly pressing "E" during self-test can speed up the sequence.

INPUT CIRCUITRY & SET-UP

There are two independent input channels on the Gemini. Various types of sensor outputs can be accommodated by appropriate DIP switch set-up. These include: TTL or CMOS logic, current sinking, current sourcing, or dry contact and more.

Channel 1 consists of a logic input and a separate low level magnetic pickup input.

Channel 2 is a completely independent count or control input channel. Like Channel 1, it can be programmed with DIP switches for a wide variety of logic inputs, and is identical to Channel 1 in this regard. For a complete detailed description of input set-up, see Appendix "A".

OVERFLOW INDICATION

The Gemini features an overflow indicator (LED) which is located to the left of the sixth digit and above the polarity annunciator. This LED will turn on if the capacity of the display (6-digits) is exceeded or if the internal count capacity (9-digits) is exceeded. Use of extremely small scale multiplier and Scale Factor Values can cause the internal count capacity to overflow before the displayed value would overflow. It should also be noted that the use of Right Hand Dummy Zeros or Scale Factors larger than one could cause the displayed value to overflow before a value of 999,999 (6-digits) is accumulated.

When the capacity of the display is exceeded, the count value will be maintained and will be valid. But if the internal count value is exceeded, then this value may no longer be valid.

The overflow LED can also turn on under certain conditions when the rate input frequency exceeds the maximum 3250 cps allowed for a rate update period of 16 sec. See Code 63 - "Rate Minimum Update Time".

PROGRAMMING INSTRUCTIONS FOR THE COUNTER/RATE VERSION OF THE GEMINI 4000

The first part of this section provides detailed descriptions of the function command codes for inputs response modes, reset modes, output terminations, etc. Then, using an actual application example, the programming instructions for a Counter/Rate version will be "walked through", to give the user a full understanding of the Gemini programming procedure. The descriptions below give the function command code first, followed by the individual mode identifier. The Function Command Code Summary in the appendix, lists all codes. (Only commands and modes pertaining to the Counter/Rate personality will be discussed in this section.)

CODE 41 - UNIT PERSONALITY

The Gemini can be programmed to operate in one of two different personalities. In each of the two unit personalities, the Gemini operates as a dual function indicator. The personality selected determines whether display channel A will indicate rate or count. In both personalities, display channel B operates as a counter.

When the Unit Personality is changed and entered, all modes and data values (Preset, Scale Factors, function codes etc.) will be automatically loaded with the factory settings for that personality. If, for any reason during programming, it is desired to return to the factory settings (while in code 41), the "+/-" key can be pushed. When the "E" key is pressed the unit will load the factory settings into the Gemini.

The programming procedure will vary for the two unit personalities. This entire section deals with the unit programmed as a Counter/Rate indicator, [41 1].

[41 1] COUNTER (B)/RATE (A) - In this mode, display channel A functions as a rate indicator and display channel B functions as a counter. See the "PROGRAMMING INSTRUCTIONS FOR THE GEMINI 4000" section for details.

[41 2] DUAL COUNTER - In this mode, both display channels, A & B, function as counters.

CODE 42 - RESET BUTTON & TERMINAL ACTUATION MODES

The "Reset Button & Terminal Actuation Modes" controls the affect that the reset button and terminal have on the two display channels. Resetting will not affect the rate display in any manner. If the output(s) is assigned to the rate channel, activating the reset button or terminal will reset the rate output(s) if that particular response mode is programmed. Resetting counter (B) will always reset the assigned output(s).

There is a separate "RST. A" terminal, which resets the Rate (A) output when activated (if output(s) is assigned to rate). It is provided to allow independent resetting of each channel.

[42 1] RESET RATE (A) OUTPUT(S)
[42 2] RESET COUNTER (B)
[42 3] RESET RATE (A) OUTPUT(S) AND COUNTER (B)

CODE 43 - INPUTS 1 & 2 RESPONSE MODES

The Gemini has six different input response modes. They are: Count(1) with Inhibit(2); Count(1) with Up/Down Control (2); Two input anticoincidence Add(1)/Subtract(2); Separate Input mode; Quadrature; and Quadrature x4. In all modes, except [43 4], Input 1 is used by both the counter and rate channels.

[43 1] COUNT WITH INHIBIT - Input 1 serves as the count and rate input. Input 2 serves as the Inhibit input. When Input 2 is low, the counter will ignore the count signal appearing at Input 1. The rate channel, however, will continue to indicate the rate of the signal on Input 1.
When Input 2 is at a high level, the signal appearing on Input 1 will be counted. The "Counter (B) Reset Modes" will determine the count direction. In applications where the Inhibit function is not actually used, the Input 2 "SRC/SNK" position of the "INPUT CONFIGURATION DIP SWITCH" should be set to the "SNK" position to provide a 7.8 Kohm pull-up resistor. This will set Input 2 to the Non-Inhibit state.

CODE 43 - INPUTS 1 & 2 RESPONSE MODES [Cont'd]

[43 2] COUNT WITH UP/DOWN CONTROL - In this mode, count direction can be controlled by the second input. Input 1 serves as the count and rate input and Input 2 serves as the direction control signal input. When Input 2 is at a high level, the counter will count up. When Input 2 is at a low level, the counter will count down. The rate is not affected by the directional control Input 2.

[43 3] TWO INPUT ANTI-COINCIDENCE ADD/SUBTRACT - This mode effectively separates count pulses which may simultaneously appear at the two inputs. The Gemini unit processes the count pulses into a string of time-separated pulses, so the internal counter will not lose any count pulses. Input 1 serves as the add and rate input (count increments) and Input 2 serves as the subtract input (count decrements).

[43 4] SEPARATE INPUT - In this mode, the two functions, Counter (B) and Rate (A) are independently controlled by the inputs. Input 1 serves as the Rate (A) input and Input 2 serves as the Counter (B) input.

[43 5] QUADRATURE COUNTING - Quadrature counting modes are primarily used in positioning and anti-jitter applications. The reason this mode works is due to the manner in which two pickups are positioned relative to each other. The signal on Input 2 is a pulse train signal shifted 90° away from the Input 1 signal. These two signals are processed by the Gemini as follows:
Input 1 serves as the count and rate input, while Input 2 serves as the quadrature input. For quadrature with single edge counting, the counter will count in a positive direction when Input 1 is a negative going edge and Input 2 is at a low level. The counter will count in a negative direction when Input 1 is a positive going edge and Input 2 is at a low level. All transitions on Input 1 are ignored when Input 2 is at a high level. These logic rules provide the basis for anti-jitter operation which will prevent false counts from occurring due to back-lash, vibration, chatter, etc.
When two edge counting is used, the quadrature mode works the same as with single edge counting when Input 2 is low. But when Input 2 is at a high level, counts at Input 1 are no longer ignored. Instead the logic rules for Input 1 are complemented, allowing both edges of Input 1 to be counted. This doubles the effective resolution of the encoded input. The rate indicator will only use the falling edge of the Input 1 signal, due to the method of rate indication used.

[43 6] QUADRATURE TIMES 4 - This mode takes the quadrature mode, with two edge counting, one step further. In quadrature times 4, both Input 1 and Input 2 serve as the count or quadrature input, depending on their state. In one instance, Input 1 will serve as the count input and Input 2 will serve as the quadrature input. In another instance, Input 1 will be the quadrature input and Input 2 will be the count input. This enables each edge, positive and negative going, of both inputs, 1 and 2, to be counted. This results in a resolution four times greater than in the basic quadrature x1 mode. As in the other modes, Input 1 is also used for the rate input. The rate indicator will only use the falling edge of the Input 1 signal, due to the method of rate indication used.

CODE 44 - COUNTER (B) NUMBER OF COUNT EDGES

The counter of the Gemini can be programmed for either single or two edge (x2) counting. The number of count edges cannot be set when the count mode is programmed for quadrature x4 operation. The Gemini will ignore any attempt to enter function command code 44 when set for quadrature x4.

[44 1] SINGLE EDGE COUNTING (x1) - The unit counts on the negative going (falling) edge of the count input signal. The count mode descriptions describe how each mode uses this method of edge counting.

[44 2] TWO EDGE COUNTING (x2) - This mode is used when doubling of the count signal input is required. The unit counts on the positive going (rising) edge of the count input signal, as well as, the negative going (falling) edge.

CODE 45 - COUNTER (B) SCALE MULTIPLIER

There are four Counter B Scale Multipliers that are available. They effectively divide the internal Count B value by 1, 10, 100, and 1000 respectively, to yield the displayed Counter B value. Note: Use of a small scale multiplier in conjunction with a small Scale Factor could cause the internal count value to be exceeded before the 6-digit display value is exceeded. See "Programming the Presets, Scale Factors, Timed Outputs & Counter Load Values" section for more details.

[45 1] x1
[45 2] x 0.1
[45 3] x0.01
[45 4] x0.001

CODE 46 - COUNTER (B) DECIMAL POINT & LEADING ZERO BLANKING

There are six basic modes of decimal point placement for the counter of the Gemini. The decimal point is placed to the right of the display digit that corresponds to the mode identifier. (The right most decimal point, digit 1, is never turned on.) A "-" sign in front of the mode identifier will inhibit leading zero blanking. The absence of a "-" sign will enable leading zero blanking.

[46 1]	0	LEADING ZERO BLANKING
[46 2]	0.0	
[46 3]	0.0 0	
[46 4]	0.0 0 0	
[46 5]	0.0 0 0 0	
[46 6]	0.0 0 0 0 0	
[46 -1]	0 0 0 0 0 0	LEADING ZERO BLANKING INHIBITED
[46 -2]	0 0 0 0 0.0	
[46 -3]	0 0 0 0.0 0	
[46 -4]	0 0 0.0 0 0	
[46 -5]	0 0.0 0 0 0	
[46 -6]	0.0 0 0 0 0	

CODE 51 - OUTPUT ASSIGNMENT

The output(s) of the Gemini 4000 can be assigned to either the rate or count channel. Assigning the output(s) to the rate [51 3] will automatically configure the "Counter (B) Reset Mode" to Reset to Zero, [56 1].

The Gemini 4200 has a Preset tracking feature which allows Preset 1 to track Preset 2. If Preset tracking is programmed, whenever the Preset 2 value is changed, the Preset 1 value will also change to maintain the same offset. For example, if Preset 1 is 100 and Preset 2 is 200, changing Preset 2 to 300 will automatically change Preset 1 to 200, maintaining same 100 unit offset. In order to change the amount of offset, the Preset 1 value is changed. The Preset tracking feature is programmed by adding a "-" modifier in front of the desired mode.

[51 1] OUTPUT 1 ASSIGNED TO RATE (A), OUTPUT 2 TO COUNTER (Gemini 4200 only)
[51 2] OUTPUTS 1 & 2 ASSIGNED TO COUNTER (B)
[51 3] OUTPUTS 1 & 2 ASSIGNED TO RATE (A)

[51 -1]
[51 -2]
[51 -3]
These modes are identical with the exception that Preset Tracking is enabled.

CODE 52 - OUTPUT 1 TERMINATION MODES

The Gemini has six "Output 1 Termination Modes" which control the way Output 1 will terminate or reset. In all modes, Output 1 will terminate immediately when the channel to which it is assigned is manually reset.

For the Gemini 4200, the Output 1 termination modes 1 & 2 are available only when both outputs are assigned to the Counter (B), [51 2].

A reverse phase mode is available on the Gemini. This refers to the complementing of the logic state of the output. With normal phase operation, when the display value reaches Preset 1, Output 1 will turn on. The reset condition of Output 1 is output off. In reverse phase operation, Output 1 turns off when the Preset 1 Value is reached. The reset condition of Output 1 is output on. (Note: The state of the relay, if used, is also reversed.) A "-" sign in front of the mode identifier will provide for reverse phase operation. The absence of a "-" sign will indicate normal phase operation.

CODE 52 - OUTPUT 1 TERMINATION MODES (Cont'd)

[52 1] TERMINATE AT OUTPUT 2 START - Output 1 will terminate when Output 2 starts. Output 1 is set for normal phase operation. (Gemini 4200 Only)

[52 2] TERMINATE AT OUTPUT 2 END - Output 1 will terminate when Output 2 ends. Output 1 is set for normal phase operation. (Gemini 4200 Only)

[52 3] TERMINATE AT MANUAL RESET - Output 1 activates when the rate or count, whichever it is assigned to, is greater than or equal to the Preset 1 Value. In this mode, once Output 1 is activated, it does not deactivate until the moment a reset occurs. Output 1 is set for normal phase operation.

[52 4] TERMINATE AT MANUAL RESET END - This mode is like the preceding, except Output 1 deactivates when reset ends. Output 1 is set for normal phase operation.

[52 5] TERMINATE AFTER TIMED OUTPUT 1 - Once Output 1 has been activated, it will deactivate after the predetermined length of time (code 53) has expired. Manual reset will override the timed output and reset Output 1. Output 1 is set for normal phase operation.

When Output 1 alone is assigned to the rate [51 1], the output will activate when the rate is greater than or equal to the Preset 1 Value. When both outputs are assigned to Rate [51 3], Output 1 will act as an "underspeed" detect. It will activate when the rate is less than or equal to the Preset 1 Value. Output 1 will activate every update time period for which the above conditions are true. If the Timed Output 1 Value, code 53, is greater than the rate update time, the output will appear to be latched on, deactivating when the rate drops below the Preset and the output time expires.

[52 6] BOUNDARY MODE - When in boundary mode, the Preset 1 Value serves as the boundary point. When the display value (count or rate) is less than the Preset 1 Value, Output 1 is not activated (normal phase). When the display value is greater than or equal to the Preset 1 Value, Output 1 is activated. If the display value were to drop below Preset 1, Output 1 would then deactivate. For negative Preset points, Output 1 is not activated when the count value is more positive than the Preset 1 Value. When the count is more negative than (only possible with counter) or equal to Preset 1, Output 1 is activated. If the count becomes more positive than the Preset 1 Value, the output again deactivates. When Output 1 is assigned to the counter and the Preset 1 value is changed, Output 1 will immediately go to the proper state. Upon power up, Output 1, if assigned to Counter B, will "remember" its power down boundary condition and go to that state. Output 1 is set for normal phase operation.

[52 -1]
[52 -2]
[52 -3]
[52 -4]
[52 -5]
[52 -6]

These modes are the same as above with the exception that the output is set for reverse phase operation.

CODE 53 - TIMED OUTPUT 1 VALUE

The Gemini has the capability of varying the Timed Output 1 Value from 0.01 second to 599.99 seconds. When the code is entered, instead of a single mode identifier digit being displayed, six digits will be shown. Refer to "Programming the Presets, Scale Factors, Timed Outputs & Counter Load Values" section for more details about entering. The timed output will be terminated if the unit is manually reset.

The Timed Output 1 Value is used only when in Timed Output 1 Termination mode, [52 5].

Note: A Timed Output Value of zero cannot be programmed into the Gemini. If a value of 0 is entered into the display and the "E" key is pressed, the unit will not enter the 0, but will stay in the data entry mode. If a new value is not entered, it will time out and the unit will continue to use its previous setting.

CODE 54 - OUTPUT 2 TERMINATION MODES (GEMINI 4200 Only)

The Gemini 4200 has six "Output 2 Termination Modes" which control the way Output 2 will terminate or reset. In all modes, Output 2 will terminate immediately when the channel to which it is assigned is manually reset.

Output 2 termination modes 1 & 2 are available only when both outputs are assigned to the Counter (B), [51 2].

A reverse phase mode is available on the Gemini 4200. This refers to the complementing of the logic state of the output. With normal phase operation, when the display value reaches Preset 2, Output 2 will turn on. The reset condition of Output 2 is output off. In reverse phase operation, Output 2 turns off when the Preset 2 Value is reached. The reset condition of Output 2 is output on. (Note: The state of the relay, if used, is also reversed.) A "-" sign in front of the mode identifier will provide for reverse phase operation. The absence of a "-" sign will indicate normal phase operation.

[54 1] TERMINATE AT OUTPUT 1 START - Output 2 will terminate when Output 1 starts. Output 2 is set for normal phase operation.

[54 2] TERMINATE AT OUTPUT 1 END - Output 2 will terminate when Output 1 ends. Output 2 is set for normal phase operation.

[54 3] TERMINATE AT MANUAL RESET - Output 2 activates when the rate or count, whichever it is assigned to, is greater than or equal to the Preset 2 Value. In this mode, once Output 2 is activated, it does not deactivate until the moment a reset occurs. Output 2 is set for normal phase operation.

[54 4] TERMINATE AT MANUAL RESET END - This mode is like the preceding, except Output 2 deactivates when reset ends. Output 2 is set for normal phase operation.

[54 5] TERMINATE AFTER TIMED OUTPUT 2 - Once Output 2 has been activated, it will deactivate after the predetermined length of time (code 55) has expired. Manual reset will override the timed output and reset Output 2. When assigned to count or rate, Output 2 will activate when the display value is greater than or equal to the Preset 2 Value. Output 2 is set for normal phase operation.

[54 6] BOUNDARY MODE - When in boundary mode, the Preset 2 Value serves as the boundary point. When the display value (count or rate) is less than the Preset 2 Value, Output 2 is not activated (normal phase). When the display value is greater than or equal to the Preset 2 Value, Output 2 is activated. If the display value were to drop below Preset 2, Output 2 would then deactivate. For negative Preset points, Output 2 is not activated when the count value is more positive than the Preset 2 Value. When the count is more negative than (only possible with counter) or equal to Preset 2, Output 2 is activated. If the count becomes more positive than the Preset 2 Value, the output again deactivates. When Output 2 is assigned to the counter and the Preset 2 value is changed, Output 2 will immediately go to the proper state. Upon power up, Output 2, if assigned to Counter B, will "remember" its power down boundary condition and go to that state. Output 2 is set for normal phase operation. Programming Boundary mode will automatically select [56 1], if [51 1 or 2] is programmed.

[54 -1]
[54 -2]
[54 -3]
[54 -4]
[54 -5]
[54 -6]

These modes are the same as above with the exception that the output is set for reverse phase operation.

CODE 55 - TIMED OUTPUT 2 VALUE (GEMINI 4200 Only)

The Gemini 4200 has the capability of varying the Timed Output 2 Value from 0.01 second to 599.99 seconds. When the code is entered, instead of a single mode identifier digit being displayed, six digits will be shown. Refer to "Programming the Presets, Scale Factors, Timed Outputs & Counter Load Values" section for more details about entering. The timed output will be terminated if the unit is manually reset.

The Timed Output 2 Value is used only when in Timed Output 2 Termination mode, [54 5].

Note: A Timed Output Value of zero cannot be programmed into the Gemini 4200. If a value of 0 is entered into the display and the "E" key is pressed, the unit will not enter the 0, but will stay in the data entry mode. If a new value is not entered it will time out and the unit will continue to use its previous setting.

CODE 56 - COUNTER (B) RESET MODES

The Gemini 4000 has six different counter reset modes. There are also two methods by which manual reset can act on the counter (reset must be enabled, see function code 66 and dip switch set-up). The first is a "maintained" reset action, where the unit is held at reset for as long as the reset terminal or reset button is activated. The second is a "momentary" reset, in which the unit resets, when reset is activated, and starts counting even though the terminal or reset button may still be active. A "-" sign in front of the mode identifier indicates "momentary" reset action, the absence of the "-" sign indicates "maintained" reset action.

For the Gemini 4200, if both outputs are assigned to the Rate Channel [51 3], or the Output 2 Termination mode is boundary [54 6], the only Counter (B) Reset mode that is available is Reset to Zero [56 1].

In Reset to Zero modes the Output (if assigned to Counter B) activates at the Preset Value. In Reset to Preset modes the Output activates at zero.

In the "Reset to Preset" modes, for proper operation, the counter normally counts down. In the "Count with Inhibit" and "Separate Inputs" input response modes, [43 1 or 4], the unit will automatically count down if a Reset to Preset mode is selected. In the other input response modes, proper input phasing is required for down counting. See "CODE 43 - INPUTS 1 & 2 RESPONSE MODES" section for more details.

Note: The Reset Button & Terminal Actuation Mode must be programmed to mode [42 2 or 3] in order to be able to manually reset the Counter (B). The activation and de-activation response time for reset is 10 msec.

Note: For the Gemini 4200, all reset to preset modes reset to preset 2 and Timed Output refers to Output 2.

[56 1] MANUAL RESET TO ZERO (RTZ) - Manual reset to zero is accomplished by pulling the "RST." terminal to "COMMON" or, if the front panel reset is enabled, by pressing the front panel reset button. Reset is "maintained".

[56 2] MANUAL RESET TO PRESET (RTP) - Manual reset to Preset is accomplished by pulling the "RST." terminal to "COMMON" or, if the front panel reset is enabled, by pressing the front panel reset button. Reset is "maintained".

[56 3] AUTOMATIC RESET TO ZERO AFTER TIMED OUTPUT - The counter automatically resets to zero when Timed Output ends. Manual reset is "maintained" and will override automatic reset. The "Output Termination Mode" should be programmed for timed output operation, [54 5], when in this mode.

[56 4] AUTOMATIC RESET TO PRESET AFTER TIMED OUTPUT - The counter automatically resets to Preset when Timed Output ends. Manual reset is "maintained" and will override automatic reset.

The "Output Termination Mode" should be programmed for timed output operation, [54 5], when in this mode.

[56 5] AUTOMATIC RESET TO ZERO AT BEGINNING OF TIMED OUTPUT (AT PRESET) - In this reset mode, the counter will automatically reset to zero at the beginning of Timed Output (at Preset). The Timed Output Value must be shorter than the time required for the counter to count to the Preset Value, otherwise, the Output will appear to be latched on. Manual reset is "maintained" and will override automatic reset. The "Output Termination Mode" should be programmed for timed output operation, [54 5], when in this mode.

[56 6] AUTOMATIC RESET TO PRESET AT BEGINNING OF TIMED OUTPUT (AT ZERO) - In this reset mode, the counter will automatically reset to Preset at the beginning of Timed Output (at zero). The Timed Output Value must be shorter than the time required for the counter to count to zero, otherwise, the Output will appear to be latched on. Manual reset is "maintained" and will override automatic reset. The "Output Termination Mode" should be programmed for timed output operation, [54 5], when in this mode.

[56 -1]
[56 -2]
[56 -3]
[56 -4]
[56 -5]
[56 -6]

These modes are the same as above with the exception that manual reset is set for "momentary" operation.

CODE 61 - RATE (A) RIGHT HAND DUMMY ZEROS

Dummy zeros can be used to alleviate display fluctuations due to an unstable input signal. These zeros effectively move significant digits to the left. Therefore, a normal count of 1 could be shown as a 10, 100, or 1000. Using the dummy zeros will make it necessary to adjust the scaling if they were not considered before.

[61 1] 1 RIGHT HAND DUMMY ZERO
[61 2] 2 RIGHT HAND DUMMY ZEROS
[61 3] 3 RIGHT HAND DUMMY ZEROS
[61 4] NO RIGHT HAND DUMMY ZEROS

CODE 62 - RATE CONVERSION FACTOR

The rate conversion factor provides a simple means of obtaining the desired rate reading, using the same Scale Factor Value as the counter, when the rate and count units are the same. In most applications, it is simply programmed to the desired time unit that the rate is to displayed in. See Appendix "F" - Scaling For Rate.

[62 1] Rate Per Second (x1)
[62 2] Rate Per Minute (x60)
[62 3] Rate Per Hour (x3600)

CODE 63 - RATE MINIMUM UPDATE TIME

The determination of the rate value uses a method in which the elapsed time is measured between the first and last pulse of the update period. The minimum update time is the shortest the time period can be. Once the minimum update time has expired, the unit will end the measurement period when the next negative going count edge occurs. If the unit does not receive the next negative count edge within the maximum update time at the start of the measurement period, the unit will end the time period and the rate display will go to zero. At very slow count rates the update time period will be the actual period of one count cycle.

[63 1] 0.5 Sec. minimum/1 Sec. maximum
[63 2] 1 Sec. minimum/2 Secs. maximum
[63 3] 2 Sec. minimum/4 Secs. maximum
[63 4] 4 Sec. minimum/8 Secs. maximum
[63 5] 8 Sec. minimum/16 Secs. maximum (max. rate = 7500 cps)
[63 6] 16 Sec. minimum/32 Secs. maximum (max. rate = 3250 cps)

CODE 64 - RATE SCALE MULTIPLIER

The Rate Scale Multiplier is used in conjunction with the Rate Scale Factor A and Rate Conversion Factor to scale the actual signal input to obtain the desired reading. See Appendix "F" - Scaling For Rate.

[64 1] x 1000
[64 2] x 100
[64 3] x 10
[64 4] x 1
[64 5] x 0.1
[64 6] x 0.01

CODE 65 - RATE (A) DECIMAL POINT & LEADING ZERO BLANKING

There are six basic modes of decimal point placement for the Rate indicator of the Gemini. The decimal point is placed to the right of the display digit that corresponds to the mode identifier. (The right most decimal point, digit 1, is never turned on.) A "-" sign in front of the mode identifier will inhibit leading zero blanking. The absence of a "-" sign will enable leading zero blanking.

[65 1]	0	LEADING ZERO BLANKING
[65 2]	0.0	
[65 3]	0.0 0	
[65 4]	0.0 0 0	
[65 5]	0.0 0 0 0	
[65 6]	0.0 0 0 0 0	
[65 -1]	0 0 0 0 0 0	LEADING ZERO BLANKING INHIBITED
[65 -2]	0 0 0 0 0.0	
[65 -3]	0 0 0 0.0 0	
[65 -4]	0 0 0.0 0 0	
[65 -5]	0 0.0 0 0 0	
[65 -6]	0.0 0 0 0 0	

CODE 66 - "OPERATOR ACCESSIBLE FUNCTIONS" MODES

The Gemini has six basic levels of "Operator Accessible Functions". Each of these levels can be modified to enable or disable manual reset. When the "PGM. DIS." (Program Disable) terminal is connected to "COMMON", access to all functions is disabled except for those listed below which will remain enabled. All of the function codes and parameters can be interrogated, regardless of the "Operator Accessible Functions" mode selected.

A "-" sign in front of the mode identifier will disable the front panel Reset button and the "RST." terminal.

Note: The front panel reset button can be independently disabled by using the disable reset DIP switch.

[66 1] NO FUNCTIONS ENABLED EXCEPT RESET - In this mode, manual reset is enabled, but none of the programming functions can be changed.

[66 2] PRESET PROGRAMMING AND RESET ENABLED - In this mode, manual reset and the programming of the Preset Values are enabled.

[66 3] SCALE FACTOR PROGRAMMING AND RESET ENABLED - In this mode, manual reset and the programming of the Scale Factor Values are enabled.

[66 4] SCALE FACTOR, PRESET PROGRAMMING AND RESET ENABLED - In this mode, manual reset and the programming of the Scale Factor and Preset Values are enabled.

[66 5] PRESET, COUNTER LOAD PROGRAMMING AND RESET ENABLED - In this mode, manual reset and the programming of the Presets and Counter Load Value are enabled.

[66 6] PRESET, SCALE FACTOR, COUNTER LOAD PROGRAMMING AND RESET ENABLED - In this mode, manual reset and the programming of the Presets, Scale Factors and Counter Load Value are enabled.

[66 -1]
[66 -2]
[66 -3]
[66 -4]
[66 -5]
[66 -6]

These modes are the same as above with the exception that manual reset is disabled.

PRESET VALUE

Whenever the display value equals the preset value (when output is assigned to that display channel), an output action will occur. This action depends on the previously programmed modes. The preset values may range from -999,999 to 999,999. (Refer to "Programming the Presets, Scale Factors, Timed Outputs & Counter Load Values" section for instructions on entering the preset values.)

The Counter (B) Scale Factor, SFB, will have a direct effect on the preset value being entered (if assigned to the counter). For a Scale Factor Value greater than one, the preset value should be an integer multiple of the Scale Factor. If it is not, the Gemini will automatically adjust the preset value up or down to force it to be evenly divisible by the Scale Factor.

"1" - PRESET 1 VALUE
"2" - PRESET 2 VALUE (GEMINI 4200 Only)

SCALE FACTORS A & B

"3" SCALE FACTOR - The Scale Factor, for which value (count or rate) is currently being displayed, is accessed by pressing the "3" key. To access the Scale Factor of the "other" display value, the "+/-" key would be pushed (to change the display to the other value), then the "3" key would be pushed.

The number of pulses counted (internal count value) is multiplied by the Scale Factor, which changes the displayed value accordingly. A Scale Factor Value of 1.0000 would result in a display of the actual number of input pulses that have been counted. The Scale Factor is used primarily for conversion from existing pulses per unit of measure to the required displayed units. This includes conversion from different units of measure (i.e feet to meters, etc.).

The Scale Factor Values may range from -5.9999 to +5.9999 (positive only for Rate (A) Scale Factor, SFA). Refer to "Programming the Presets, Scale Factors, Timed Outputs & Counter Load Values" section for entering instructions. It is important to note that the precision of a counter application cannot be improved by using a Scale Factor greater than one. To accomplish greater precision, more

pulse information must be generated per measuring unit. For example, if 5 pulses are being received per foot of material, the precision of 10th of feet cannot be attained by simply programming a Scale Factor of 2.0000, even though the display is reading in 10ths. In this case, the display will increment by two for each count input. Thus if an odd Preset Value was entered, such as 6.7 ft., the Gemini will alter the preset to read in even tenths of feet.

Note: Use of a small Scale Factor in conjunction with a small scale multiplier could cause the internal count value (counter) to be exceeded before the 6-digit display value is exceeded.

COUNTER LOAD VALUE

The Counter Load Value is provided to allow the user to modify the count value. The Counter Load Value is reset to zero when the Gemini is powered up. Once the Counter Load Value has been changed, it will remain set to that value until the unit is powered down and up. Accessing the Counter Load Value for the counter that is currently being displayed is accomplished by pushing the "E" button, and while holding it down, also pushing the "+/-" button. See "Programming the Presets, Scale Factors, Timed Outputs & Counter Load Values" section for entering instructions.

"E" & "+/-" - Counter Load Value for the currently displayed counter.

DUAL PRESET COUNTER & RATE APPLICATION

A wire screen manufacturer requires a cut to length system, and in addition, a prewarning of an overspeed condition. The cutting machine is equipped with an existing 12 tooth gear, driving a one foot circumference feed roller.

The Gemini 4200's counter is to read in feet. When 15,000 feet has been accumulated on the take up roll, the counter output is to turn on and deactivate the drive system. The operator will then make the cut, load a new take up roll and reset the Gemini to start a new roll.

In addition to cut to length, the same Gemini 4200 is to be used to indicate the speed of the wire screen in feet per minute, while providing a "overspeed" warning. The normal running speed of the material is 225 feet per minute. The maximum allowable speed of the process is 250 feet per minute.

HARDWARE SETUP

The accompanying drawing shows how the hardware is setup for this application. A Model PSAC proximity sensor is used to sense the teeth on the gear. The application does not require bi-directional counting, so the Gemini 4200 will be programmed for the Count with Inhibit "Inputs 1 & 2 Response Mode". In this mode, both the rate indicator and counter will utilize the same input signal. The switch settings and the wiring connections are as shown. The Input 2 switch positions 5-7 are set to put the Input 2 in the non-inhibit state with maximum noise immunity.

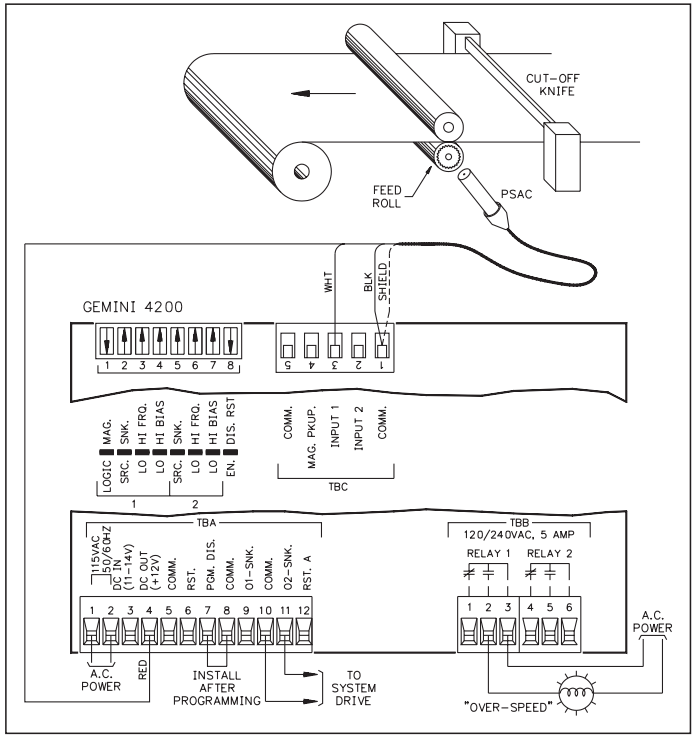
SCALING THE COUNTER

In order to scale the counter, the procedure and formulas in Appendix "E" - Scaling for Counting are used.

In converting pulse units to "Display Units", it is known that 12 pulses are equivalent to 1 revolution of the feed roll, which is equivalent to 1 foot linear travel of the wire screen. The "Display Unit", therefore is 1 foot and the "Number of Pulses" per display unit is 12.

STEP 1 - Calculate the Total Scaling Factor, "K_T", using Formula #1 of Appendix "E".

$$K_T = \text{Display Unit} / \text{Number of Pulses}$$
$$K_T = 1/12 = 0.083333$$



STEP 2 - Determine the Number of Count Edges, "NCE", necessary for this application, and calculate the Remaining Scaling required, "K_R", using Formula #2 of Appendix "E".

Since the Total Scaling Factor, "K_T", is less than 1, single edge counting can be used, therefore, the Number of Count Edges, "NCE", is 1.

$$K_R = K_T/NCE$$
$$K_R = 0.083333/1 = 0.083333$$

STEP 3 - Determine the Scale Multiplier Value, "SCM", and calculate the Scale Factor, "SF", using Formula #3 of Appendix "E".

A Scale Multiplier value of 0.1 is chosen to provide the maximum number of significant digits in the Scale Factor.

$$SF = K_R/SCM$$

$$SF = 0.083333/0.1 = 0.8333$$

SCALING THE RATE INDICATOR

In this application the rate indicator can be programmed with the same scale factor and scale multiplier values as obtained when scaling the counter. The only other scaling that would be required is choosing the proper Rate Conversion Factor, to obtain the display in the desired time units. The application calls for the rate to be indicated in feet per minute, therefore, the Rate Per Minute Rate Conversion Factor is selected.

STEP BY STEP PROGRAMMING OF THE GEMINI 4200

STEP 1 - Enter code 41 (Unit Personality). Select and enter a mode identifier of 1, for the Gemini to operate as a Counter and Rate indicator.

STEP 2 - Enter code 42 (Reset Button & Terminal Actuation Modes). Select and enter mode 2 to reset the counter when reset is activated.

STEP 3 - Enter code 43 (Inputs 1 & 2 Response Modes). Select and enter mode 1, "Count with Inhibit".

STEP 4 - Enter code 44 (Counter B Number of Count Edges). Select and enter mode 1 for single edge counting.

STEP 5 - Enter code 45 (Counter B Scale Multiplier). Select and enter mode 2 for a scale multiplier of 0.1.

STEP 6 - Enter code 46 (Counter B Decimal Point & Leading Zero Blanking). Select and enter mode 1 for no decimal point.

STEP 7 - Enter code 51 (Output Assignment). Select and enter mode 1 to assign Output 1 to the rate indicator and Output 2 to the counter.

STEP 8 - Enter code 52 (Output 1 Termination Modes). Select and enter mode 6 for boundary operation. Output 1 will activate when the maximum speed value, Preset 1, is exceeded. Output 1 will deactivate when the rate decreases to a value below the maximum speed.

Note: The Timed Output 1 Value, code 53, is not used in this application.

STEP 9 - Enter code 54 (Output 2 Termination Modes). Select and enter mode 4 for Output 2 Terminate at Manual Reset.

Note: The Timed Output 2 Value, code 55, is not used in this application.

STEP 10 - Enter code 56 (Counter B Reset Modes). Select and enter mode 1 for manual reset to zero.

STEP 11 - Enter code 61 (Rate Right Hand Dummy Zeros). Select and enter mode 4 for no right hand dummy zeros.

STEP 12 - Enter code 62 (Rate Conversion Factor). Select and enter mode 2 for a Rate Per Minute conversion factor.

STEP 13 - Enter code 63 (Rate Minimum Update Time). Select and enter mode 1 for a minimum update time of 0.5 Second. If the rate display jumps around, a larger minimum update time can be used to provide averaging.

STEP 14 - Enter code 64 (Rate Scale Multiplier). Select and enter mode 5 for a Scale Multiplier of 0.1, as previously determined.

STEP 15 - Enter code 65 (Rate Decimal Point & Leading Zero Blanking). Select and enter mode 1 for no decimal point.

STEP 16 - Enter code 66 (Operator Accessible Functions Modes). Select and enter mode (+)1 for no functions except reset enabled. When the "PGM.DIS." terminal is connected to "COMM.", the only changes that will be possible is resetting the counter.

STEP 17 - The "+/-" key is pushed, if necessary, so that the rate is being indicated on the Gemini 4200. The "3" key is then pushed to call up the Rate Scale Factor. The value is changed to 0.8333.

STEP 18 - The "+/-" key is pushed, so that the count is being indicated on the Gemini 4200. The "3" key is then pushed to call up the Counter Scale Factor. The value is changed to 0.8333.

STEP 19 - Enter a Preset 1 value of 250, by pushing the "1" key and changing the value to 250.

STEP 20 - Enter a Preset 2 value of 15,000, by pushing the "2" key and changing the value to 15,000.

After the unit is programmed, the "PGM. DIS." terminal is connected to "COMM." to prevent any unauthorized or accidental mode changes. The function codes can, however, be called up to view or verify that the proper modes are entered.

PROGRAMMING INSTRUCTIONS FOR THE DUAL COUNTER VERSION OF THE GEMINI 4000

The first part of this section provides detailed descriptions of the function command codes for input response modes, reset modes, output terminations, etc. Then, using an actual application example, the programming instructions for the Dual Counter version will be "walked through", to give the user a full understanding of the Gemini 4000 programming procedure. The descriptions below give the function command code first, followed by the individual mode identifier. The Function Command Code Summary in the appendix, lists all codes. (Only commands and modes pertaining to the Dual Counter personality will be discussed in this section.)

CODE 41 - UNIT PERSONALITY

The Gemini can be programmed to operate in one of two different unit personalities. In each of the two personalities the Gemini operates as a dual function indicator. The personality selected determines whether display channel A will indicate rate or count. In both personalities, display channel B operates as a counter.

When the Unit Personality is changed and entered, all modes and data values (Presets, Scale Factors, function codes, etc.) will be automatically loaded with the factory settings for that personality. If, for any reason during programming, it is desired to return to the factory settings, the "+/" key can be pushed while in code 41. Then, when the "E" key is pressed the unit will load the factory settings into the Gemini.

The programming procedures for the two unit personalities will vary. This entire section deals with the unit programmed as a Dual Counter indicator, [41 2].

[41 1] COUNTER (B)/RATE (A) - In this mode, display channel A functions as a rate indicator and display channel B functions as a counter. See "PROGRAMMING INSTRUCTIONS FOR COUNTER/RATE VERSION OF THE GEMINI" section for details.

[41 2] DUAL COUNTER - In this mode, both display channels {A & B} function as counters.

CODE 42 - RESET BUTTON & TERMINAL ACTUATION MODES

The "Reset Button & Terminal Actuation modes" control the affect that the reset button and terminal have on the two display channels.

There is a separate "Rst A" terminal which resets Counter A, when activated. It is provided to allow independent resetting of each channel.

[42 1] RESET COUNTER A
[42 2] RESET COUNTER B
[42 3] RESET COUNTER A & B

CODE 43 - INPUTS 1 & 2 RESPONSE MODES

The Gemini has six different input response modes. They are: Count(1) with Inhibit(2); Count(1) with Up/Down Control (2); Two input anticoincidence Add(1)/Subtract(2); Separate Input mode; Quadrature; and Quadrature x4. In all modes, except [43 4], both counters will respond identically to both inputs. These modes are most suitable for applications where one channel is used for control, and the other for totalizing counts.

[43 1] COUNT WITH INHIBIT - Input 1 serves as the count input. Input 2 serves as the Inhibit input. When Input 2 is low, the counters will ignore the count signal appearing at Input 1. When Input 2 is at a high level, the pulses appearing at Input 1 will be counted.

[43 2] COUNT WITH UP/DOWN CONTROL - In this mode, count direction can be controlled by the second input. Input 1 serves as the count input and Input 2 serves as the direction control signal input. When Input 2 is at a high level, the counters will count up. When Input 2 is at a low level, the counters will count down.

[43 3] TWO INPUT ANTICOINCIDENCE ADD/SUBTRACT - This mode effectively separates count pulses which may simultaneously appear at the two inputs. The Gemini unit processes the count pulses into a string of time-separated pulses, so the internal counters will not lose any counts. Input 1 serves as the add input (count increments) and Input 2 serves as the subtract input (count decrements).

[43 4] SEPARATE INPUT - In this mode, the two counters, A & B, are independently controlled by the inputs. Input 1 serves as the Counter A input and Input 2 serves as the Counter B input.

[43 5] QUADRATURE COUNTING - Quadrature counting modes are primarily used in positioning and anti-jitter applications. The reason this mode works is due to the manner in which two pickups are positioned relative to each other. The signal on Input 2 is a pulse train signal shifted 90° away from the signal on Input 1. These two signals are processed by the Gemini as follows:
Input 1 serves as the count input, while Input 2 serves as the quadrature input. For quadrature with single edge counting, the counters will count in a positive direction when Input 1 is a negative going edge and Input 2 is at a low level. The counters will count in a negative direction when Input 1 is a positive going edge and Input 2 is at a low level. All transitions on Input 1 are ignored when Input 2 is at a high level. These logic rules provide the basis for anti-jitter operation which will prevent false counts from occurring due to back-lash, vibration, chatter, etc.
When two edge counting is used, the quadrature mode works the same as with single edge counting when Input 2 is low. But when Input 2 is at a high level, counts at Input 1 are no longer ignored. Instead the logic rules for Input 1 are complemented, allowing both edges of Input 1 to be counted. This doubles the effective resolution of the encoded input.

[43 6] QUADRATURE TIMES 4 - This mode takes the quadrature mode, with two edge counting, one step further. In quadrature times 4, both Input 1 and Input 2 serve as the count or quadrature input, depending on their state. In one instance, Input 1 will serve as the count input and Input 2 will serve as the quadrature input. In another instance, Input 1 will be the quadrature input and Input 2 will be the count input. This enables each edge, positive and negative going, of both inputs, 1 and 2, to be counted. This results in a resolution four times greater than in the basic quadrature x1 mode.

CODE 44 - COUNTERS A & B NUMBER OF COUNT EDGES

The counters of the Gemini can be programmed for either single or two edge (x2) counting. The number of count edges cannot be set when the count mode is programmed for quadrature x4 operation. The Gemini will ignore any attempt to enter function command code 44, when set for quadrature x4.

[44 1] SINGLE EDGE COUNTING (x1) - The unit counts on the negative going (falling) edge of the count input signal. The Inputs 1 & 2 Response mode descriptions describe how each mode uses this method of edge counting.

[44 2] TWO EDGE COUNTING (x2) - This mode is used when doubling of the count signal input is required. The unit counts on the positive going (rising) edge of the count input signal, as well as, the negative going (falling) edge.

CODE 45 - COUNTER B SCALE MULTIPLIER

There are four “Counter B Scale Multipliers” that are available. They effectively divide the internal count B value by 1, 10, 100, and 1000 respectively, to yield the displayed Counter B value. Note: Use of a small scale multiplier in conjunction with a small Scale Factor could cause the internal count value to be exceeded before the 6-digit display value is exceeded. See “Programming the Presets, Scale Factors, Timed Outputs & Counter Load Values” section for more details.

[45 1] x1
[45 2] x0.1
[45 3] x0.01
[45 4] x0.001

CODE 46 - COUNTER B DECIMAL POINT & LEADING ZERO BLANKING

There are six basic modes of decimal point placement for Counter B of the Gemini. The decimal point is placed to the right of the display digit that corresponds to the mode identifier. (The right most decimal point, digit 1, is never turned on.) A "-" sign in front of the mode identifier will inhibit leading zero blanking. The absence of a "-" sign will enable leading zero blanking.

[46 1]	0	LEADING ZERO BLANKING
[46 2]	0.0	
[46 3]	0.0 0	
[46 4]	0.0 0 0	
[46 5]	0.0 0 0 0	
[46 6]	0.0 0 0 0 0	
[46 -1]	0 0 0 0 0 0	LEADING ZERO BLANKING INHIBITED
[46 -2]	0 0 0 0 0.0	
[46 -3]	0 0 0 0.0 0	
[46 -4]	0 0 0.0 0 0	
[46 -5]	0 0.0 0 0 0	
[46 -6]	0.0 0 0 0 0	

CODE 51 - OUTPUT ASSIGNMENT

The output of the Gemini 4100 is assigned to Counter B, or for the Gemini 4200 one can be assigned to Counter B and the other to Counter A. When both are assigned to Counter B, the Gemini will automatically configure the Counter A Reset Mode to Reset to Zero, [61 1].

The Gemini 4200 has a Preset tracking feature which allows Preset 1 to track Preset 2. If Preset tracking is programmed, whenever the Preset 2 value is changed, the Preset 1 value will also change to maintain the same offset. For example, if Preset 1 is 100 and Preset 2 is 200, changing Preset 2 to 300 will automatically change Preset 1 to 200, maintaining the same 100 unit offset. In order to change the amount of offset, the Preset 1 value is changed. The Preset tracking feature is programmed by adding a "-" modifier in front of the desired mode.

[51 1] OUTPUT 1 ASSIGNED TO COUNTER A, OUTPUT 2 ASSIGNED TO COUNTER B (Gemini 4200 Only)

[51 2] OUTPUT 1 & 2 ASSIGNED TO COUNTER (B)

CODE 52 - OUTPUT 1 TERMINATION MODES

The Gemini has six "Output Termination Modes", which control the way Output 1 will terminate or reset. In all modes, Output 1 will terminate immediately when the counter to which it is assigned is manually reset.

Output 1 termination modes 1 & 2 are available only with a Gemini 4200 and when both outputs are assigned to Counter B, [51 2].

A reverse phase mode is available on the Gemini. This refers to the complementing of the logic state of the output. With normal phase operation, when the display value reaches the Preset 1, Output 1 will turn on. The reset condition of Output 1 is output off. In reverse phase operation, the Output 1 turns off when the Preset 1 is reached. The reset condition of Output 1 is output on. (Note: The state of the relay, if used, is also reversed.) A "-" sign in front of the mode identifier will provide for reverse phase operation. The absence of a "-" sign will indicate normal phase operation.

[52 1] TERMINATE AT OUTPUT 2 START - Output 1 will terminate when Output 2 starts. Output 1 is set for normal phase operation. (Gemini 4200 Only)

[52 2] TERMINATE AT OUTPUT 2 END - Output 1 will terminate when Output 2 ends. Output 1 is set for normal phase operation. (Gemini 4200 Only)

[52 3] TERMINATE AT MANUAL RESET - Output 1 activates when the Counter A or Counter B value, whichever it is assigned to, is greater than or equal to the Preset 1 Value. In this mode, once Output 1 is activated, it does not deactivate until the moment a reset occurs. Output 1 is set for normal phase operation.

[52 4] TERMINATE AT MANUAL RESET END - This mode is like the preceding, except Output 1 deactivates when reset ends. Output 1 is set for normal phase operation.

[52 5] TERMINATE AFTER TIMED OUTPUT 1 - Once the output has been activated, it will deactivate after the predetermined length of time (code 53) has expired. Manual reset will override the timed output and reset Output 1. Output 1 is set for normal phase operation.

[52 6] BOUNDARY MODE - When in boundary mode, the Preset 1 Value serves as the boundary point. When the Counter A or B Value (whichever it is assigned to) is less than Preset 1, Output 1 is not activated (normal phase). When the Counter A or B Value is greater than or equal to Preset 1, Output 1 is activated. If the Counter A or B Value were to drop below Preset 1, Output 1 would then deactivate. For negative Preset points, Output 1 is not activated when the Counter A or B Value is more positive that the Preset 1 Value. When the count is more negative than or equal to Preset 1, Output 1 is activated. If the count becomes more positive than Preset 1, Output 1 again deactivates. When the Preset 1 value is changed, Output 1 will immediately go to the proper state. Upon power up, Output 1 will "remember" its power down boundary condition and go to that state. Output 1 is set for normal phase operation. Programming Boundary mode will automatically select [61 1] when [51 1] is programmed.

[52 -1]
[52 -2]
[52 -3]
[52 -4]
[52 -5]
[52 -6]

These modes are the same as above with the exception that the output is set for reverse phase operation.

CODE 53 - TIMED OUTPUT 1 VALUE

The Gemini has the capability of varying the Timed Output 1 Value from 0.01 second to 599.99 seconds. When the code is entered, instead of a single mode identifier digit being displayed, six digits will be shown. Refer to "Programming the Presets, Scale Factors, Timed Outputs & Counter Load Values" section for more details about entering. The timed output will be terminated if the unit is manually reset.

Note: A Timed Output Value of zero cannot be programmed into the Gemini. If a value of 0 is entered into the display and the "E" key is pressed, the unit will not enter the 0, but will stay in the data entry mode. If a new value is not entered, it will time out and the unit will continue to use its previous setting.

CODE 54 - OUTPUT 2 TERMINATION MODES

The Gemini 4200 has six "Output 2 Termination Modes", which control the way Output 2 will terminate or reset. In all modes, Output 2 will terminate immediately when Counter B is manually reset.

Output 2 termination modes 1 & 2 are available only when both outputs are assigned to Counter B, [51 2].

A reverse phase mode is available on the Gemini 4200. This refers to the complementing of the logic state of the output. With normal phase operation, when the display value reaches the Preset 2, Output 2 will turn on. The reset condition of Output 2 is output off. In reverse phase operation, the Output 2 turns off when the Preset 2 is reached. The reset condition of Output 2 is output on. (Note: The state of the relay, if used, is also reversed.) A "-" sign in front of the mode identifier will provide for reverse phase operation. The absence of a "-" sign will indicate normal phase operation.

[54 1] TERMINATE AT OUTPUT 1 START - Output 2 will terminate when Output 1 starts. Output 2 is set for normal phase operation.

[54 2] TERMINATE AT OUTPUT 1 END - Output 2 will terminate when Output 1 ends. Output 2 is set for normal phase operation.

[54 3] TERMINATE AT MANUAL RESET - Output 2 activates when Counter B is greater than or equal to the Preset 2 Value. In this mode, once Output 2 is activated, it does not deactivate until the moment a reset occurs. Output 2 is set for normal phase operation.

[54 4] TERMINATE AT MANUAL RESET END - This mode is like the preceding, except Output 2 deactivates when reset ends. Output 2 is set for normal phase operation.

[54 5] TERMINATE AFTER TIMED OUTPUT 2 - Once Output 2 has been activated, it will deactivate after the predetermined length of time (code 55) has expired. Manual reset will override the timed output and reset Output 2. Output 2 is set for normal phase operation.

CODE 54 - OUTPUT 2 TERMINATION MODES (Cont'd)

[54 6] BOUNDARY MODE - When in boundary mode the Preset 2 Value serves as the boundary point. When the Counter B Value is less than Preset 2, Output 2 is not activated (normal phase). When the Counter B Value is greater than or equal to Preset 2, Output 2 is activated. If the Counter B Value were to drop below Preset 2, Output 2 would then deactivate. For negative Preset points, Output 2 is not activated when the Counter B Value is more positive that the Preset 2 Value. When the count is more negative than or equal to Preset 2, Output 2 is activated. If the count becomes more positive than Preset 2, Output 2 again deactivates. When the Preset 2 value is changed, Output 2 will immediately go to the proper state. Upon power up, Output 2 will "remember" its power down boundary condition and go to that state. Output 2 is set for normal phase operation.

Programming Boundary mode will automatically select [56 1].

[54 -1]
[54 -2]
[54 -3]
[54 -4]
[54 -5]
[54 -6]

These modes are the same as above with the exception that the output is set for reverse phase operation.

CODE 55 - TIMED OUTPUT 2 VALUE (GEMINI 4200 ONLY)

The Gemini 4200 has the capability of varying the Timed Output 2 Value from 0.01 second to 599.99 seconds. When the code is entered, instead of a single mode identifier digit being displayed, six digits will be shown. Refer to "Programming the Presets, Scale Factors, Timed Outputs & Counter Load Values" section for more details about entering. The timed output will be terminated if the unit is manually reset.

Note: A Timed Output Value of zero cannot be programmed into the Gemini 4200. If a value of 0 is entered into the display and the "E" key is pressed, the unit will not enter the 0, but will stay in the data entry mode. If a new value is not entered, it will time out and the unit will continue to use its previous setting.

CODE 56 - COUNTER B RESET MODES

The Gemini has six different Counter B reset modes. Note: For Gemini 4200 all reset to preset modes reset to preset 2. There are also two methods by which manual reset can act on the counter (reset must be enabled, see function code 66 and dip switch set-up). The first is a "maintained" reset action, where the unit is held at reset for as long as the reset terminal or reset button is activated. The second is a "momentary" reset, in which the unit resets, when reset is activated, and starts counting even though the reset terminal or reset button may still be active. A "-" sign in front of the mode identifier indicates "momentary" reset action, the absence of the "-" sign indicates "maintained" reset action.

In "Reset to Zero" modes the Output activates at the Preset Value. In "Reset to Preset" modes, the Output activates at zero.

In the "Reset to Preset" modes, for proper operation, the counter normally counts down. In the "Count with Inhibit" and "Separate Inputs" input response modes, [43 1, or 4], the unit will automatically count down if a Reset to Preset mode is selected. In the other input response modes, proper input phasing is required for down counting. See "CODE 43 - INPUTS 1 & 2 RESPONSE MODES" section for details.

The activation and de-activation response time for reset is 10 msec.

[56 1] MANUAL RESET TO ZERO (RTZ) - Manual reset to zero is accomplished by pulling the "RST." terminal to "COMMON" or, if the front panel reset is enabled, by pressing the front panel reset button. Reset is "maintained".

[56 2] MANUAL RESET TO PRESET (RTP) - Manual reset to Preset is accomplished by pulling the "RST." terminal to "COMMON" or, if the front panel reset is enabled, by pressing the front panel reset button. Reset is "maintained".

[56 3] AUTOMATIC RESET TO ZERO AFTER TIMED OUTPUT - The counter automatically resets to zero when Timed Output ends. Manual reset is "maintained" and will override automatic reset.

[56 4] AUTOMATIC RESET TO PRESET AFTER TIMED OUTPUT - The counter automatically resets to Preset when Timed Output ends. Manual reset is "maintained" and will override automatic reset.

[56 5] AUTOMATIC RESET TO ZERO AT BEGINNING OF TIMED OUTPUT (AT PRESET) - In this reset mode, the counter will automatically reset to zero at the beginning of Timed Output (at Preset). The Timed Output Value must be shorter than the time required for the counter to count to the Preset 2 Value, otherwise, the Output will appear to be latched on. Manual reset is "maintained" and will override automatic reset.

[56 6] AUTOMATIC RESET TO PRESET AT BEGINNING OF TIMED OUTPUT (AT ZERO) - In this reset mode, the counter will automatically reset to Preset at the beginning of Timed Output (at zero). The Timed Output Value must be shorter than the time required for the counter to count to zero, otherwise, the Output will appear to be latched on. Manual reset is "maintained" and will override automatic reset.

[56 -1]
[56 -2]
[56 -3]
[56 -4]
[56 -5]
[56 -6]

These modes are the same as above with the exception that manual reset is set for "momentary" operation.

CODE 61 - COUNTER (A) RESET MODES

There are two ways to reset Counter A. The reset button or "RST." terminal can be used, if the appropriate "Reset Button & Terminal Activation Mode" is programmed. The second way is the use of the "RST.A" terminal. If it is necessary to reset Counter A & B independently, the "Reset Button & Terminal Activation Mode" should be programmed to Reset Counter B, and the "RST.A" terminal should then be used to reset Counter A.

For the Gemini 4200, if both outputs are assigned to Counter B [51 2], or the Output 1 Termination mode is boundary [54 6], the only Counter A Reset mode that is available is Reset to Zero [61 1].

There are two methods by which manual reset can act on Counter A (reset must be enabled - see function code 66 and dip switch set-up). The first is a "maintained" reset action, where the unit is held at reset for as long as the reset terminal or reset button is activated. The second is a "momentary" reset, in which the unit resets, when reset is activated, and starts counting even though the terminal or reset button may still be active. A "-" sign in front of the mode identifier indicates "momentary" reset action, the absence of the "-" sign indicates "maintained" reset action.

The activation and de-activation response time for reset is 10 msec.

[61 1] MANUAL RESET TO ZERO (RTZ) - Manual reset to zero is accomplished by activating the appropriate reset button or terminal. Reset is "maintained".

The following modes are only available on the Gemini 4200

[61 2] MANUAL RESET TO PRESET 1 (RTP) - Manual reset to Preset 1 is accomplished by pulling the "RST." terminal to "COMMON" or, if the front panel reset is enabled, by pressing the front panel reset button. Reset is "maintained".

[61 3] AUTOMATIC RESET TO ZERO AFTER TIMED OUTPUT 1 - The counter automatically resets to zero when Timed Output 1 ends. Manual reset is "maintained" and will override automatic reset.

[61 4] AUTOMATIC RESET TO PRESET 1 AFTER TIMED OUTPUT 1 - The counter automatically resets to Preset 1 when Timed Output 1 ends. Manual reset is "maintained" and will override automatic reset.

[61 5] AUTOMATIC RESET TO ZERO AT BEGINNING OF TIMED OUTPUT 1 (AT PRESET 1) - In this reset mode, the counter will automatically reset to zero at the beginning of Timed Output 1 (at Preset 1). The Timed Output 1 Value (code 53) must be shorter than the time required for the counter to count to the Preset 1 Value, otherwise, Output 1 will appear to be latched on. Manual reset is "maintained" and will override automatic reset.

[61 6] AUTOMATIC RESET TO PRESET 1 AT BEGINNING OF TIMED OUTPUT 1 (AT ZERO) - In this reset mode, the counter will automatically reset to Preset 1 at the beginning of Timed Output 1 (at zero). The Timed 1 Output Value (code 53) must be shorter than the time required for the counter to count to zero, otherwise, Output 1 will appear to be latched on. Manual reset is "maintained" and will override automatic reset.

[61 -1]
[61 -2]
[61 -3]
[61 -4]
[61 -5]
[61 -6]

These modes are the same as above with the exception that manual reset is set for "momentary" operation.

CODE 64 - COUNTER A SCALE MULTIPLIER

There are four Counter A scale multipliers that are available. They effectively divide the internal Counter A Value by 1, 10, 100, and 1000 respectively, to yield the displayed Counter A Value. Note: Use of a small scale multiplier in conjunction with a small Scale Factor could cause the internal Counter A Value to be exceeded before the 6-digit display value is exceeded.

[64 1] x1
[64 2] x0.1
[64 3] x0.01
[64 4] x0.001

CODE 65 - COUNTER A DECIMAL POINT & LEADING ZERO BLANKING

There are six basic modes of decimal point placement for Counter A of the Gemini. The decimal point is placed to the right of the display digit that corresponds to the mode identifier. (The right most decimal point, digit 1, is never turned on.) A "-" sign in front of the mode identifier will inhibit leading zero blanking. The absence of a "-" sign will enable leading zero blanking.

[65 1]	0	LEADING ZERO BLANKING
[65 2]	0.0	
[65 3]	0.0 0	
[65 4]	0.0 0 0	
[65 5]	0.0 0 0 0	
[65 6]	0.0 0 0 0 0	
[65-1]	0 0 0 0 0 0	LEADING ZERO BLANKING INHIBITED
[65-2]	0 0 0 0 0.0	
[65-3]	0 0 0 0.0 0	
[65-4]	0 0 0.0 0 0	
[65-5]	0 0.0 0 0 0	
[65-6]	0.0 0 0 0 0	

CODE 66 - "OPERATOR ACCESSIBLE FUNCTIONS" MODES

The Gemini has six basic levels of "Operator Accessible Functions". Each of these levels can be modified to enable or disable manual reset. When the "PGM. DIS." (program disable) terminal is connected to "COMMON", access to all functions is disabled except for those listed below which will remain enabled. All of the function codes and parameters can be interrogated, regardless of the "Operator Accessible Functions" mode selected.

A "-" sign in front of the mode identifier will disable the front panel Reset button and the "RST." terminal.

Note: The front panel reset button can be independently disabled by using the disable reset DIP switch.

[66 1] NO FUNCTIONS ENABLED EXCEPT RESET - In this mode, manual reset is enabled, but none of the programming functions can be changed.

[66 2] PRESET PROGRAMMING AND RESET ENABLED - In this mode, manual reset and the programming of the Preset Values are enabled.

[66 3] SCALE FACTOR PROGRAMMING AND RESET ENABLED - In this mode, manual reset and the programming of the Scale Factor Values are enabled.

[66 4] SCALE FACTOR, PRESET PROGRAMMING AND RESET ENABLED In this mode, manual reset and the programming of the Scale Factor and Preset Values are enabled.

[66 5] PRESET, COUNTER LOAD PROGRAMMING, AND RESET ENABLED - In this mode, manual reset and the programming of the Presets and Counter Load Values are enabled.

[66 6] PRESET, SCALE FACTOR, COUNTER LOAD PROGRAMMING, AND RESET ENABLED - In this mode, manual reset and the programming of the Preset, Scale Factor and Counter Load Values are enabled.

[66 -1]	These modes are the same as above with the exception that reset is disabled.
[66 -2]	
[66 -3]	
[66 -4]	
[66 -5]	
[66 -6]	

PRESET VALUES

Whenever the display value equals the preset value, an output action will occur. This action depends on the previously programmed modes. The preset values may vary from -999,999 to 999,999. (Refer to "Programming the Presets, Scale Factors, Timed Outputs & Counter Load Values" for instructions on entering the preset values.)

The Scale Factor will have a direct effect on the preset value being entered. For a Scale Factor Value greater than one, the preset value should be an integer multiple of the Scale Factor. If it is not, the Gemini will automatically adjust the preset value up or down to force it to be evenly divisible by the Scale Factor.

"1" - PRESET 1 VALUE
"2" - PRESET 2 VALUE (GEMINI 4200 Only)

SCALE FACTORS A & B

"3" SCALE FACTOR - The Scale Factor, for the Value (Counter A or Counter B) that is currently being displayed, is accessed by pressing the "3" key. To access the Scale Factor of the "other" display value, the "+/-" key would be pushed (to change the display to the other value), then the "3" key would be pushed.

The number of pulses counted (internal count value) is multiplied by the Scale Factor, which changes the displayed value accordingly. A Scale Factor Value of 1.0000 would result in a display of the actual number of input pulses that have been counted. The Scale Factor is used primarily for conversion from existing pulses per unit of measure to the required displayed units. This includes conversion from different units of measure (i.e feet to meters, etc.). The Scale Factor Values may range from -5.9999 to +5.9999. Refer to "Programming the Presets, Scale Factors, Timed Output & Counter Load Values" for entering instructions.

It is important to note that the precision of a counter application cannot be improved by using a Scale Factor greater than one. To accomplish greater precision, more pulse information must be generated per measuring unit. For example, if 5 pulses are being received per foot of material, the precision of 10th of feet cannot be attained by simply programming a Scale Factor of 2.0000, even though the display is reading in 10ths. In this case, the display will increment by two for each count input. Thus if an odd preset value was entered, such as 6.7 ft., the Gemini will alter the preset to read in even tenths of feet.

Note: Use of a small Scale Factor in conjunction with a small scale multiplier could cause the internal count value to be exceeded before the 6-digit display value is exceeded.

COUNTER LOAD VALUES

The Counter Load Value is provided to allow the user to modify the Counter A or B values. The Counter Load Values are reset to zero when the Gemini is powered up. Once the Counter Load Value has been changed, it will remain set to that value until the unit is powered down and up. Accessing the Counter Load Value for the counter that is currently being displayed is done by pushing the "E" button and while being held down also pushing the "+/-" button.

"E" & "+/-" - Counter Load Value for the currently displayed counter.

DUAL COUNTER BATCHING APPLICATION

A typical application for the Gemini 4200 will require a slow down output and a final cut output for cut. In this application the user also desires a total count of pieces cut per shift, or per order. The Gemini 4200 can easily be programmed to handle these requirements.

A manufacturer of cardboard packaging inserts needs to cut various length cardboard inserts to a 32ndth of an inch tolerance. To achieve this accuracy, an RPGB 1200 coupled to a length sensor conversion bracket and a 1 foot circumference wheel will be used. The sensor will provide 1200 pulses per foot or 100 pulses per inch. This will enable the cut be made to 100th of an inch accuracy.

The length of the cardboard insert will vary from run to run, however the slow down output needs to occur 5 inches before the final cut is to be made. This requirement can be handled easily with the Gemini 4200's preset tracking feature. The Preset 1 value is initially programmed to be 5 inches less than the Preset 2 value. (Preset 2 must be programmed first.) Then whenever the length of the cardboard insert is changed (Preset 2), the Gemini will automatically adjust Preset 1 to be 5 inches less than the new Preset 2 value.

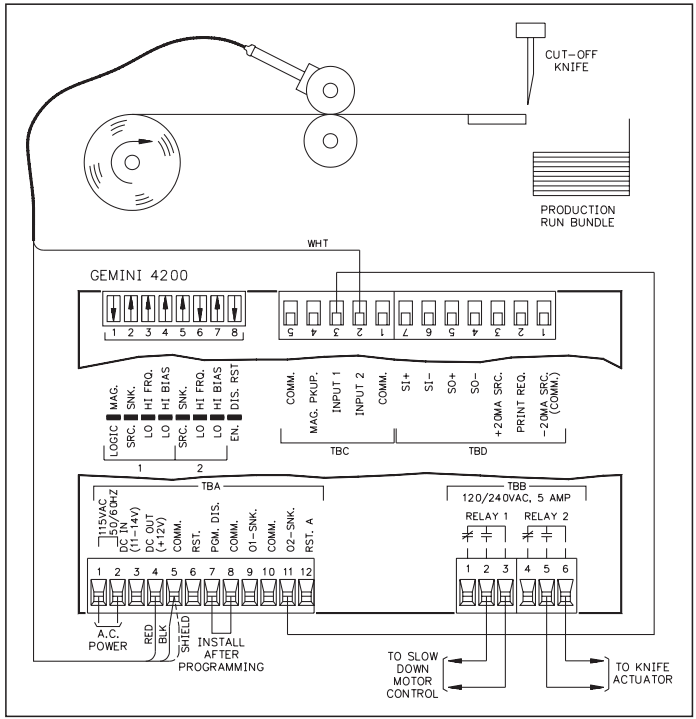
The last requirement is to totalize the number of pieces cut. This is achieved by using the output cut pulse at "O2 SNK", as an input count pulse to Input 1 of the Gemini 4200. The Inputs 1 & 2 Response mode of the unit would be programmed to the "Separate Inputs" mode. Then, whenever a cut is made, the Gemini would increment Counter A to provide a total count of pieces cut.

HARDWARE SET-UP

The application drawing shows how the hardware for this system is to be connected.

The normally open contact of relay 1 is connected to the slow down actuator. The normally open contact of relay 2 is connected to the knife actuator. The "O2 SNK" output is connected to Input 1, which will provide a input pulse to Counter A each time a piece is cut.

The Dip switches are setup as shown. Input 1 is set-up to work with an open collector output. The number of pieces cut will be far less than 100/ sec. therefore the "HI/LO FRQ" switch for Input 1 is placed in the "LO FRQ" position for higher noise immunity. Input 2 is also set-up to work with an open collector output. The "HI/LO FRQ" switch is placed in the "HI FRQ" position since the count frequencies involved will be over 100 cps. The "EN/DIS RST" switch (8), is set to "EN RST" to allow front panel reset.



SCALING FOR COUNTER A

Counter A is used to totalize the number of pieces cut. There is 1 pulse provided for each piece cut. Counter A, therefore, does not require special scaling. The Gemini 4200 is simply left at its factory settings of 1 for Scale Factor A and Scale Multiplier A.

SCALING FOR COUNTER B

Counter B is used to control the length of the cardboard insert. The display reading for Counter B is to be in hundredths of an inch. The "Number of Pulses" per 1200 "Display Units" (1200 hundredths of an inch = 1 foot) is 1200. It can easily be seen that 1 pulse will provide for 1 "Display Unit" of indication (1 hundredth of an inch). The Gemini 4200 can therefore be left at its Scale Factor B and Scale Multiplier B factory settings of 1. The "Counter A & B Number of Count Edges", code 44, is also left at the factor set value of 1.

STEP BY STEP PROGRAMMING OF THE GEMINI 4200

STEP 1 - Enter code 41 (Unit Personality). Select and enter mode 2 to set the Unit Personality to Dual Counter.

STEP 2 - Enter code 42 ("Reset Button & Terminal Actuation Mode"). Select and enter mode 2 so reset will reset Counter B. This will allow Counter B to be reset when the front panel reset button is pushed.

STEP 3 - Enter code 43 ("Inputs 1 & 2 Response Modes"). Select and enter mode 4 for Separate Inputs mode (Input 1 = Counter A input, Input 2 = Counter B input).

STEP 4 - Enter code 44 ("Counters A & B Number of Count Edges"). Select and enter mode 1 for single edge counting.

STEP 5 - Enter code 45 (Counter B Scale Multiplier). Select and enter mode 1 for a scale multiplier of 1.

STEP 6 - Enter code 46 (Counter B Decimal Point & Lead Zero Blanking). Select and enter mode 3 for a decimal point in the hundredths location.

STEP 7 - Enter code 51 (Output Assignment). Select and enter mode (-)2 to assign both outputs to Counter B and enable preset tracking.

STEP 8 - Enter code 52 (Output 1 Termination Modes). Select and enter mode 2 for termination at Output 2 end.

Note: The Timed Output 1 Value, code 53 is not used in this application.

STEP 9 - Enter code 54 (Output 2 Termination Modes). Select and enter mode 5 for timed output operation.

STEP 10 - Enter code 55 (Timed Output 2 Value). Change the value to 0.50 and enter.

STEP 11 - Enter code 56 (Counter B Reset Modes). Select and enter mode 5 for Automatic Reset to Zero at Preset 2.

Note: Code 61 (Counter A Reset Modes) was automatically selected to mode 1, Reset to Zero, when mode [51 2] was programmed.

STEP 12 - Enter code 64 (Counter A Scale Multiplier). Select and enter mode 1 for a scale multiplier of 1.

STEP 13 - Enter code 65 (Counter A Decimal Point & Leading Zero Blanking). Select and enter mode 1 for no decimal point.

STEP 14 - Enter code 66 (Operator Accessible Functions Modes). Select and enter mode 2 for Preset programming and reset enabled. When the "PGM.DIS." terminal is connected to "COMM.", the only changes that will be possible are resetting the unit and changing the Preset.

The Gemini 4200 in now fully programmed. Jumper the "PGM.DIS." terminal to "COMM." to prevent accidental program changes and to enable the "Operator Accessible Functions".

20 MA CURRENT LOOP COMMUNICATIONS

The Gemini 4000's 20 mA Current Loop Communications Option allows a "two-way" serial communications link to be established in order to monitor the count, rate, Presets and Scale Factors from a remote location. Some typical devices that can be connected with the Gemini are: a printer, terminal, programmable controller, or host computer. For devices that use RS232, a GCM Serial Converter Module is available to convert the 20 mA Current Loop signals to RS232 and vice-versa.

There are two loops that must be established. One for sending commands to the Gemini and one for receiving the data values from the Gemini. Up to sixteen Geminis can be connected together in the "loop". These units are assigned unit addresses by setting the Serial DIP Switches on each unit. The applications can be as simple as attaching a printer to obtain hard copy of the count information or as involved as using a host computer to automatically set up the Presets and Scale Factors of a number of Gemini units.

With the Serial Loop Option, the following functions can be performed:

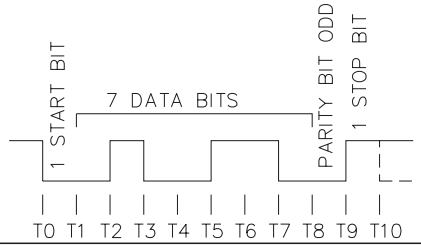
1. Interrogation of the Count, Rate, Presets, and Scale Factors.
2. Changing of the Presets and Scale Factors.
3. Resetting of the Count values.
4. Automatic print-out when using a printer and the Print Request Terminal.
5. Change viewed display channel.

COMMUNICATION FORMAT

Data is sent by switching off and on the current in the 20 mA current loop. Data is received by monitoring the switching action and interpreting the codes that are transmitted. In order for data to be interpreted correctly, there must be identical formats and Baud Rates. The format that the Gemini will accept is: 1 start bit, 7 data bits, 1 odd parity bit, and 1 stop bit. The Baud Rates that are available are: 300, 600, 1200 and 2400.

The selection of the Baud Rate is accomplished by setting DIP switches. Refer to the Current Loop Installation section, for set-up instructions.

FIG. 1: DATA FORMAT-10 BIT FRAME [300, 600, 1200, 2400 Baud]



SENDING COMMANDS & DATA TO THE GEMINI

When sending commands to the Gemini, a command string must be constructed. The command string may consist of command codes, value identifiers, and numerical data. Below is a list of commands and value identifiers that are used when communicating with the Gemini.

COMMAND	DESCRIPTION
N (4EH)	Address command; followed by a unit address number 1-15 and one of the following commands.
P (50H)	Transmit per Print Options command.
R (52H)	Reset command; operates on Count values and output
T (54H)	Transmit Value command; operates on Rate or Count values, Preset and Scale Factors.
V (56H)	Change Value command; operates on Scale Factors, and the Preset.
D (44H)	Change Display command; operates on Display values E & F.

VALUE IDENTIFIER	DESCRIPTION	MNEMONIC
A (41H)	Preset 1	(PS1)
B (42H)	Preset 2	(PS2)
C (43H)	Scale Factor A	(SFA)
D (44H)	Scale Factor B	(SFB)
E (45H)	Rate or Count A	(CTA)
F (46H)	Count B	(CTB)

The command string is constructed by using the above commands and value identifiers along with the data values that are required. Data values may or may not contain the decimal point if a decimal point is programmed into the Gemini. The Gemini will accept the decimal points, however, it does not interpret them in any way. Leading zeros can be eliminated, however, all trailing zeros must be present. For example, if a Scale Factor of 1.0000 is to be sent, the data value can be transmitted as 1.0000 or 10000. If a "1" is transmitted, the Scale Factor will be changed to 0.0001.

The Address command is used to allow a command to be directed to a specific unit in the Serial Communications Loop. Whenever the unit address is zero, transmission of the Address command is not required. This is done for applications which do not require more than one Gemini. For applications that require several units, it is recommended that each Gemini in the loop be given a separate address. If they are given the same address, a command such as the Transmit Value Command, will cause all the units to respond at the same time, resulting in erroneous data.

The command string is constructed in a specific logical sequence. The Gemini will not accept command strings that do not follow this sequence. Only one operation can be performed per command string. Below is the procedure to be used when constructing a command string.

1. If the Gemini, to which the command is to be sent, is assigned an address other than zero, the first two characters of the command string must consist of the Address Command (N) and the address number of the unit (1-15).
2. The next characters in the command string is the actual command that the Gemini is to perform and the value identifier if it pertains to the command. (A command such as the Transmit per Print Options, "P", command does not require a Value Identifier.)
3. If the "Change Value" command is being used, the next characters in the command string is the numerical data value.
4. The last character in the command string is the command terminator (*). This character must be sent in order to tell the Gemini that the command string is complete, so that they can begin processing the command.

Below are some typical examples of properly constructed command strings.

(EX. 1) Change Preset 1 on the Gemini with address of 2 to 00123.4.

COMMAND STRING: N2VA1234*

(EX. 2) Have the Gemini with address of 3 transmit the Count B value.

COMMAND STRING: N3TF*

(EX. 3) Reset Counter B of the Gemini with address of 0.

COMMAND STRING: RF*

As shown, all commands must be terminated with a "Command Terminator" (* or 2AH). The Gemini will not process the command until the terminator is sent. If illegal commands or characters are sent to the Gemini, they still would need to be terminated by an (*). If they are not terminated, the next command will not be accepted.

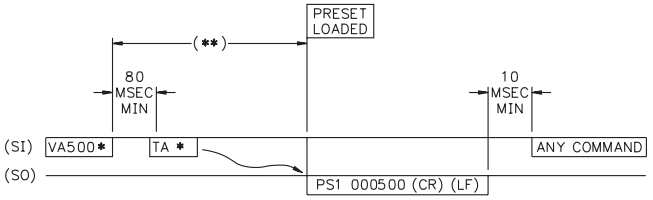
When writing application programs in Basic, the transmission of spaces or carriage return and line feed should be inhibited by using the semicolon delimiter with the "PRINT" statement. The Gemini will not accept a carriage return or line feed as valid characters.

When a "Change Value" command is sent to the Gemini, a short amount of time is required for the unit to process the data. This time increases with the count rate. During this time, only one additional command may be sent to the Gemini. This may be done 80 msec after the transmission of the "Change Value" command. After the second command has been transmitted, the unit will ignore any further commands until 10 msec after both the "Change Value" and second command have been processed. It is recommended that a "Transmit Value" command follow a "Change Value" Command. If this is done, the reception of the data can provide a timing reference for sending another command and will insure that the change has occurred.

SENDING COMMANDS & DATA TO THE GEMINI (Cont'd)

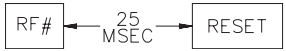
The timing diagrams show the timing considerations that need to be made.

FIG. 2: TIMING FOR SENDING COMMANDS



(**) *This is the time that it takes the Gemini 4000 to process the preset. It varies with the Count Rate and Scale Factor Value.*

FIG. 3: RESET COMMAND TIMING

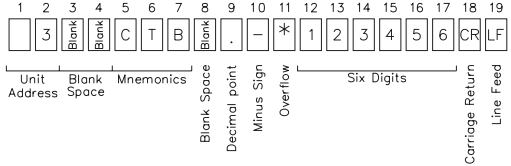


RECEIVING DATA FROM THE GEMINI

Data is transmitted from the Gemini when a "Transmit Value" or "Transmit per Print Options" command is sent to the unit, or when the "PRINT REQ." terminal is activated. The Gemini can transmit 6 values: display channel A, display channel B, Preset 1, Preset 2, Scale Factor A, and Scale Factor B. A list of the abbreviations used when the Gemini transmits the values are shown below.

CTA - Counter A or Rate A Value
CTB - Counter B Value
PS1 - Preset 1
PS2 - Preset 2
SFA - Scale Factor A
SFB - Scale Factor B

A typical transmission, with the "PR. ID" (Print ID) switch in the up position, is shown below.



The first two digits transmitted are the unit address followed by two blank spaces. If the unit address is 0, the first locations will be left blank. The next three letters are the abbreviation for the mnemonic value followed by one blank space. The actual values are transmitted last. Negative values are indicated by a *"-"* sign. For positive values, the *"+"* sign is not transmitted. Overflowed count values are shown by an asterisk preceding the most significant digit of the value. The decimal point position will *"float"* within the data field depending on the actual value it represents.

For peripheral control purposes, a single line transmission will have a <CR> attached to the end of the above string. For a *"T"* command or each line of a block transmission, only the above character string is sent. For the last line of a block transmission, a <SP> <CR> <LF> is attached to the end of the above character string. An example of a typical serial transmission:

3 CTB -1234.56 < CR> < LF>

If the *"Print Request"* terminal initiates the transmission, a 400 msec delay is inserted before the transmission to keep multiple transmissions from overrunning the printer.

When the Print ID switch is in the down position, the unit will not transmit the characters before the data value *(address, Value ID, spaces)* or the 400 msec printer delay. The same above value when transmitted with the *"PR.ID"* switch in the down position, is transmitted as:

-1234.56 < CR> < LF>

Note: When using the Gemini with a printer, with the "Print ID" switch in the down position, some printers may not work, since the printer delay is not transmitted.

PRINT OPTIONS

The various Print Options are used mainly in conjunction with a printer and the Print Request Terminal. They provide a choice of Gemini data values to be printed when either the Print Request Terminal is activated or the "Transmit per Print Options" (P) command is sent to the Gemini. The various Print Options available are:

A. Print Display A count or rate value
B. Print Display B Count Value
C. Print Display A & B Values
D. Print Preset 1 & 2 and Scale Factors A & B
E. Print Display B, Presets 1 & 2, and Scale Factors A & B
F. Print Display A, Presets 1 & 2, and Scale Factors A & B
G. Print Display A & B, Presets 1 & 2, and Scale Factors A & B

A typical print-out is shown below. The Print Options are selected by setting S3, S4 and S5 on the Serial DIP Switch. See Page 34 for the various switch settings.

```
1    CTA     000054
1    PS1      000100
1    PS2      000500
1    SFA      01.0000
1    SFB     02.5000
```

CURRENT LOOP INSTALLATION

WIRING CONNECTIONS

When wiring the 20 mA current loop, remove the 7-position terminal block (TBD), located on the right side of the top board. Refer to the numbers listed with the terminal descriptions below or on the top label, and install each wire in its proper location on the terminal block. When all connections are made, replace the terminal block into its proper location.

It is recommended that shielded (screened) cable be used for serial communications. This unit meets the EMC specifications using ALPHA #2404 cable or equivalent. There are higher grades of shielded cable, such as, four conductor twisted pair, that offer an even higher degree of noise immunity.

TERMINAL DESCRIPTIONS FOR TERMINAL BLOCK TBD

1. -20 mA SRC (COMM.) - Common
2. PRINT REQUEST - The Print Request Terminal is pulled low to request the Gemini to transmit according to the Print Options mode that has been selected. (Minimum Activation time = 25 msec.)
3. +20 mA SRC - The 20 mA SRC terminal provides the source current for one of the loops.
4. SO- (Serial Out-) -
5. SO+ (Serial Out+) -

The Gemini transmits the requested data on these terminals. They are connected in series to the receive input of the device to be connected.

6. SI- (Serial In-) -
7. SI+ (Serial In+) -

The Gemini receives commands on these terminals. They are connected in series with the transmit or output terminals of the device to be connected.

Note: The serial Input terminals must be held in the mark condition (current on) in order for the Gemini to respond to a Print Request terminal activation.

SERIAL DIP SWITCH SET-UP

The Serial DIP switches are accessible through the side of the Gemini. A list of the DIP switch positions and their functions are shown in the figure at right.

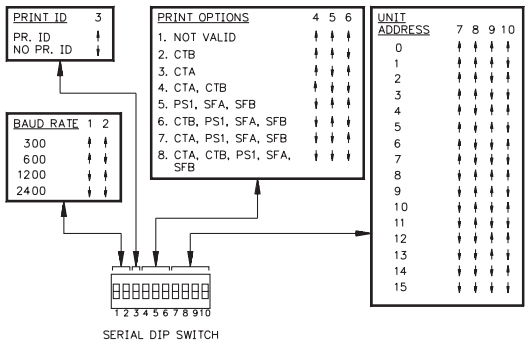
BR0 & BR1, BAUD RATE - Set-up is shown , at right. When changing the Baud Rate, the unit should be powered-down and then powered back up again. The unit will only recognize a baud rate change upon power-up, after activating the *"Print Request"* terminal or after a few characters have been sent at the new baud rate *(If the two previous conditions have not occurred, the Gemini will see the characters as erroneous and it will check the baud rate and set itself to operate at the new rate).*

PR.ID - PRINT ID. - When this switch is in the up position, the Gemini will print the unit address, data value ID and the data value when a transmission is requested. The unit will also insert a 400 msec delay between transmissions when the *"P"* command or Print Request terminal is used. This switch position is generally used when the unit is connected with a printer.

When the switch is in the down position, the Gemini will transmit only the data value, without the unit address and data ID. The 400 msec delay, described above, will not be inserted. This switch position usage is intended for applications where the Gemini is communicating with a computer. In these circumstances printing the address and value ID and inserting a 400 msec print delay is usually unnecessary and needlessly slows down communication throughput.

PC0, PC1, & PC2, PRINT OPTIONS - Used to control which values are printed out when the Print Request terminal is activated or when the Transmit per Print Options command "P" is sent to the Gemini 4000.

AD0, AD1, AD2, & AD3 UNIT ADDRESS - These switches are used to give each unit a separate address when more than one unit is connected in the Loop. See below for Switch Set-up.

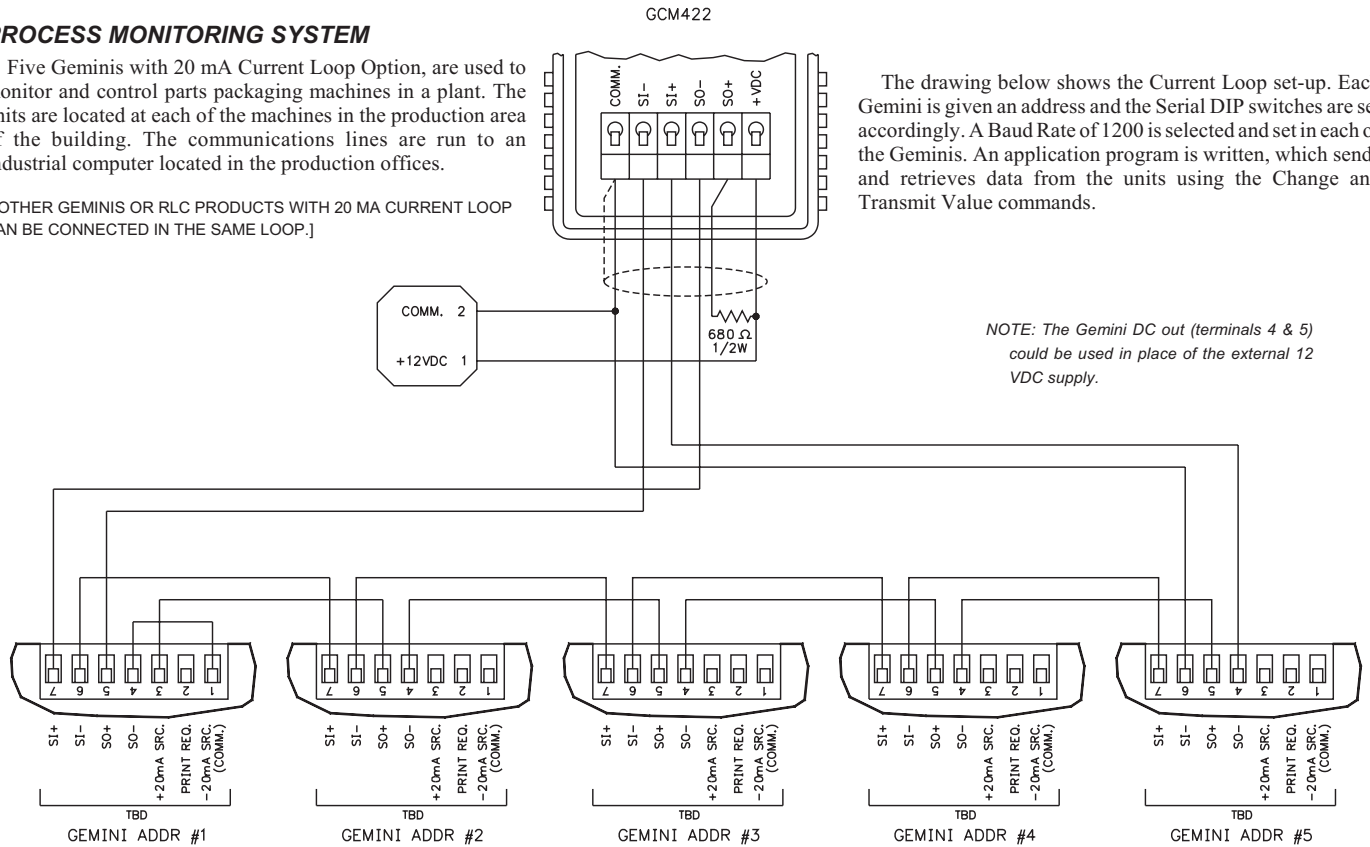


PROCESS MONITORING SYSTEM

Five Geminis with 20 mA Current Loop Option, are used to monitor and control parts packaging machines in a plant. The units are located at each of the machines in the production area of the building. The communications lines are run to an Industrial computer located in the production offices.

[OTHER GEMINIS OR RLC PRODUCTS WITH 20 MA CURRENT LOOP CAN BE CONNECTED IN THE SAME LOOP.]

The drawing below shows the Current Loop set-up. Each Gemini is given an address and the Serial DIP switches are set accordingly. A Baud Rate of 1200 is selected and set in each of the Geminis. An application program is written, which sends and retrieves data from the units using the Change and Transmit Value commands.



NOTE: The Gemini DC out (terminals 4 & 5) could be used in place of the external 12 VDC supply.

TROUBLESHOOTING GEMINI SERIAL COMMUNICATIONS

If problems are encountered when trying to get the Gemini*(s)* and host device or printer to communicate, the following checklist can be used to help find the solution.

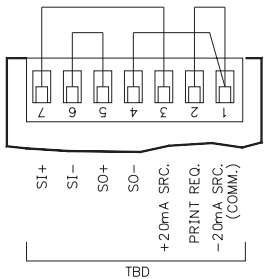
1. Check all wiring. Refer to the previous application examples and use them as a guide to check your serial communication wiring. Proper polarity of all Geminis and other peripherals must be observed. If a multimeter or ammeter is available, insert it in series in each Serial loop and check for current flow with all units powered up. If no current is flowing, either the loop is not wired correctly, or some other fault has occurred. If too much current has been sent through a Serial Input or Output, the unit may have been damaged. If a Gemini is suspected, it can be tested for operation by using the Serial Loop-back test described in the next section.
2. If the Gemini is set-up with a *"host computer"*, device or printer, check to make sure that the computer or device is configured with the same communication format as the Gemini. The only communication format the Gemini will accept is; 1 start bit, 7 data bits, odd parity, and 1 stop bit.
3. Check the baud rate settings and make sure all devices in the loop are set to the same baud rate.
4. Check the Gemini's unit address. If the Address command is not used when transmitting a command to the Gemini, the Gemini's address must be set to 0. See *"Sending Commands & Data to the Gemini"* section for command structure.
5. If two-way communications are to be established between the Gemini and a computer, try getting the computer to receive transmissions from the Gemini first. The Gemini's *"PRINT REQ."* terminal can be used to initiate the transmissions from the Gemini.
6. When sending commands to the Gemini, the * *(2Ah)* must terminate the command. NO CARRIAGE RETURNS *(0Dh)* OR LINE FEED *(0Ah)* CHARACTERS SHOULD BE SENT TO THE GEMINI. If they are sent, the Gemini will not respond to the next command.
7. For applications where 1200 Baud or lower is used, the command terminator (*) can be sent before the string to eliminate any illegally transmitted characters.

SERIAL LOOP-BACK SELF-TEST

The Gemini has a Serial Loop-back Self-test feature. This test enables the user to verify the operation of the Gemini when problems are encountered trying to get the Gemini and *"Host device"* communicating. In this test, the Gemini's Serial Input and Output Loops are connected together with the 20 mA source supplying the loop current. The Gemini then transmits data *"to itself"*. If the data is received properly, the Gemini will change its Scale Factor B value to 0.1111. To perform the loop-back test, follow the test sequence as described below.

1. With the unit powered down, wire up the serial terminal block, *"TBD"*, as shown in the diagram below.
2. Set the Gemini's unit address to 15 *(set switches 7-10 of the Serial DIP Switch to the down position)*.
3. Apply power to the unit. On power-up the Gemini will perform the loop-back test. To check the results: Call up the Scale Factor B value by pressing the *"3"* key while the Counter B value is being displayed. If the Serial loop is functioning properly the Scale Factor B value will be 0.1111. If this result is not obtained, double check the connections with those shown in the diagram, and the unit address switch positions and repeat step 3.
4. If the connection between the Print Request terminal, *"PRINT REQ."* and *"COMMON"* is disconnected while the unit is under power, the Scale Factor B value will change back to its previous setting.

If the unit does not pass this test, contact your local Red Lion Controls distributor.



APPENDIX "A" - INSTALLATION & INPUT CONFIGURATION SWITCH SET-UP

Before installing the Gemini into the panel, the user should first become familiar with the unit. It may also be desirable to program the unit and appropriate DIP switches for the application at hand (Refer to the "Programming and Applications" sections). Once the unit is programmed, the settings will be saved in memory. The Program Disable "PGM. DIS." terminal should be connected to "COMM." to prevent accidental or unauthorized programming changes.

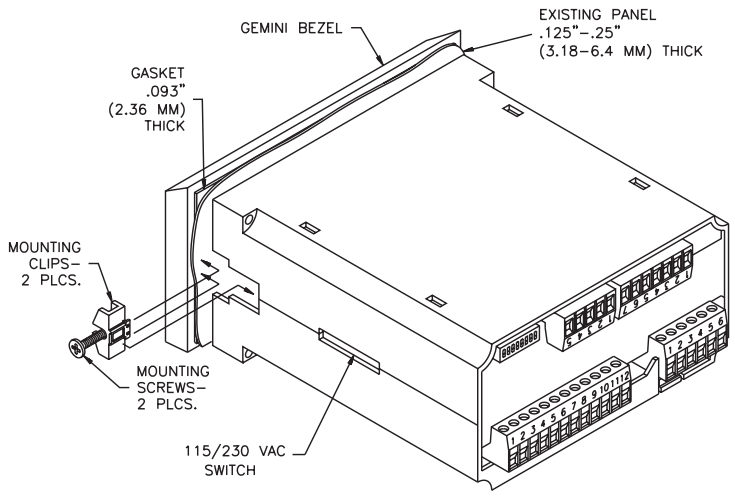
Installation Environment

The unit should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

The bezel should be cleaned only with a soft cloth and neutral soap product. Do NOT use solvents. Continuous exposure to direct sunlight may accelerate the aging process of the bezel.

Do not use tools of any kind (screwdrivers, pens, pencils, etc.) to operate the keypad of the unit.

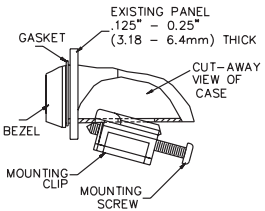
PANEL MOUNTING {Note: See Appendix "B" for dimensions}



The Gemini is intended to be mounted into an enclosed panel with a gasket to provide a water-tight seal. The unit meets NEMA 4/IP65 requirements for indoor use when properly installed. Two mounting clips and screws are provided for easy installation. Consideration should be given to the thickness of the panel. A panel which is too thin may distort and not provide a water-tight seal. (Recommended minimum panel thickness is 1/8".)

After the panel cut-out has been completed and deburred, remove the backing from the adhesive side of the gasket, and carefully apply the gasket to the panel. **DO NOT APPLY THE ADHESIVE SIDE OF THE GASKET TO THE COUNTER BEZEL.** Insert the unit into the panel. Install the screws into the narrow ends of the mounting clips as shown in the drawing to the left. Thread the screws into the clips until the pointed end just protrudes through the other side.

Install each of the two mounting clips by inserting the wide lip of the clips into the wide end of the holes located on either side of the case. Tighten the screws evenly, applying uniform compression, thus providing a water-tight seal. ***CAUTION**: Only minimum pressure is required to seal panel. Do NOT over tighten mounting screws.*



SELECT AC POWER (115/230 VAC)

The AC power to the unit must be selected for either 115 VAC or 230 VAC. The selector switch is located through an access slot on the side of the case (See the Installation Figure on the previous page, or the label on the case). The unit is shipped from the factory with the switch in the 230 VAC position.
Caution: Damage to the unit may occur if the AC selector switch is set incorrectly.

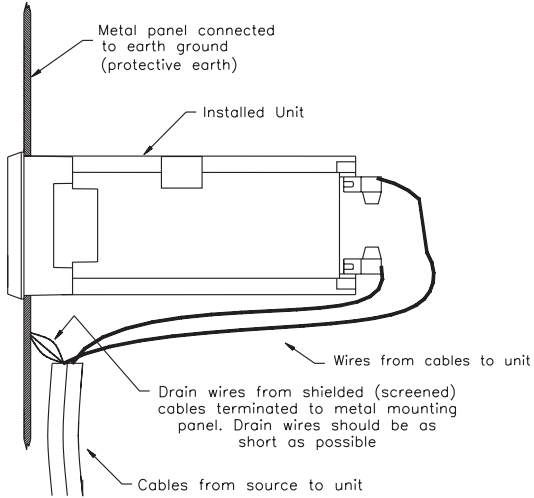
EMC Compliance Installation

This unit complies with the Electromagnetic Compatibility (EMC) standards listed in the specifications. Compliance to the EMC standards was demonstrated by means of a test set-up using the following installation methods:

1. Unit mounted in a metal panel connected to earth ground (protective earth).
2. Shielded (screened) cables for Signal and Control inputs with shield drain wire connected to earth ground at the mounting panel only.
   Belden #8451 2 conductor, #22 AWG twisted pair with foil shield and drain wire
   Belden #8771 3 conductor, #22 AWG with foil shield and drain wire
   Alpha #2404 4 conductor, #22 AWG with foil shield and drain wire
3. Metal bezel of unit connected to mounting panel with 9 inch (23 cm) ground lead from rear bezel screw. Test: Immunity to ESD per EN61000-4-2.
4. Shaffner FN610 EMI Filter placed on DC mains cable when using optional DC power. Test: Electrical Fast transients (burst) (EFT) EN 61000-4-4.
5. Shaffner FN610 EMI Filter placed on DC mains cable when using optional DC power supply. Test: RF Conducted Immunity per ENV 50141.

Shield Termination

EMC compliance installation testing had the drain wire for the shielded cable terminated as shown. The drain wire was less than 0.5" (12.7 mm) long.



Additional EMC Installation Guidelines

Although this unit is designed with a high degree of immunity to ElectroMagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into the unit may be different for various installations. Listed below are some additional EMC guidelines for successful installation in an industrial environment.

1. The unit should be mounted in a metal enclosure, which is properly connected to protective earth.
   a. If the bezel is exposed to high Electro-Static Discharge (ESD) levels, above 4 Kv, it should be connected to protective earth. This can be done by making sure the metal bezel makes proper contact to the panel cut-out or connecting the bezel screw with a spade terminal and wire to protective earth.
2. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
   c. Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.
3. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
4. Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.
5. In very electrically noisy environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection.
   Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:
   Ferrite Suppression Cores for signal and control cables:
   Fair-Rite # 0443167251 (RLC #FCOR0000)
   TDK # ZCAT3035-1330A
   Steward #28B2029-0A0
   Line Filters for input power cables:
   Schaffner # FN610-1/07 (RLC #LFIL0000)
   Schaffner # FN670-1.8/07
   Corcom #1VR3
   Note: *Reference manufacturer's instructions when installing a line filter.*
6. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.
7. Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI.
   Snubbers:
   RLC #SNUB0000

WIRING CONNECTIONS

After the unit has been mechanically mounted, it is ready to be wired. All wiring connections are made on removable plug-in terminal blocks. There is a separate terminal block for the bottom board (TBA), relay board (TBB), count inputs (TBC), and optional Serial Communications (TBD). When wiring the unit, remove the terminal block and use the numbers on the label to identify the position number with the proper function. Simply strip the wire, leaving approximately ¼" bare wire exposed (stranded wires should be tinned with solder). Insert the wire into the terminal and tighten down the screw until the wire is clamped in tightly. Each terminal can accept up to two 18-gage wires. After the terminal block is wired, install it in the proper location on the PC board. Wire each terminal block in this manner.

All conductors should meet voltage and current ratings for each terminal. Also cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the unit (AC or DC) be protected by a fuse or circuit breaker.

POWER WIRING

AC Versions

AC Power Wiring

Primary AC power is connected to terminals 1 and 2, labeled AC. To reduce the chance of noise spikes entering the AC line and affecting the counter, an AC feed separate from that of the load should be used to power the counter. Be certain that the AC power to the counter is relatively "clean" and within the specified range. Connecting power from heavily loaded circuits or circuits that also power loads that cycle on and off, (contacts, relays, motors, etc.) should be avoided.

The voltage selector switch, located on the side of the unit, is used to select the proper voltage. The switch is a slide movement type and can be set by using a small screwdriver. If the switch is towards the front of the unit, it is set for 230 VAC input. The switch is in the 230 VAC position when shipped from the factory.

Note: Before applying power to the unit, make sure the AC power selector switch is set for the proper voltage setting.

DC Power Wiring

The DC power is connected to terminals 3 & 5, marked DC IN and COMM. respectively. The DC power source must be capable of supplying the unit's rated current (700 mA max.) and be within the specified 11 to 14 VDC range. The power source can be a 12 V battery or an external power supply that is capable of supplying the unit's rated current. It is not necessary to provide battery backup to retain count information. The Gemini has non-volatile memory that stores information on power down, thereby eliminating the need for battery back-up.

Output Power

DC OUT terminal provides a DC output for sensor power (+12 VDC ±25%). The maximum sensor current is 100 mA. This terminal number is model dependent. Refer to the label on the unit for correct number.

RELAY WIRING

To prolong contact life and suppress electrical noise interference due to the switching of inductive loads, it is good installation practice to install a snubber across the contactor. Follow the manufacturer's instructions for installation.

Note: Snubber leakage current can cause some electro-mechanical devices to be held ON.

SERIAL COMMUNICATIONS

The Gemini can be purchased with a 20 mA Current Loop Communications Option. On these units, refer to the "Current Loop Communications" section of the manual, for wiring and operational procedures of the Serial Loop.

INPUT 1 & MAGNETIC PICKUP INPUT

The Magnetic Pickup Input and Logic Input 1 utilize some common circuitry. For this reason the Input 1 switches are used to set up both the Magnetic and Logic Input 1. S1 selects between Magnetic Pickup Input and Logic Input 1. WHEN A MAGNETIC PICKUP IS BEING USED, S2 MUST BE IN THE "SNK" POSITION or the unit will not count.

S3 (HI/LO FRQ) and S4 (HI/LO BIAS) do not effect the Magnetic Pickup Input and their settings are inconsequential. When S1 is in the Logic position, the Magnetic Pickup Input is disabled and Input 1 can be used as a logic input.

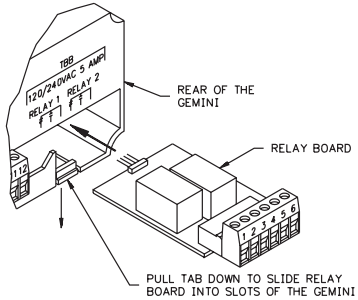
Note: A Magnetic Pickup type sensor should not be used unless a large enough signal is provided at all speeds of operation.

INPUT 2

Input 2 is designed specifically for Logic type inputs. When Input 1 is set up for Logic operation, both Inputs 1 and 2 operate identically. DIP switch positions S5, S6, and S7 function the same as S2, S3, and S4.

INSTALLATION & REMOVAL OF THE RELAY BOARD

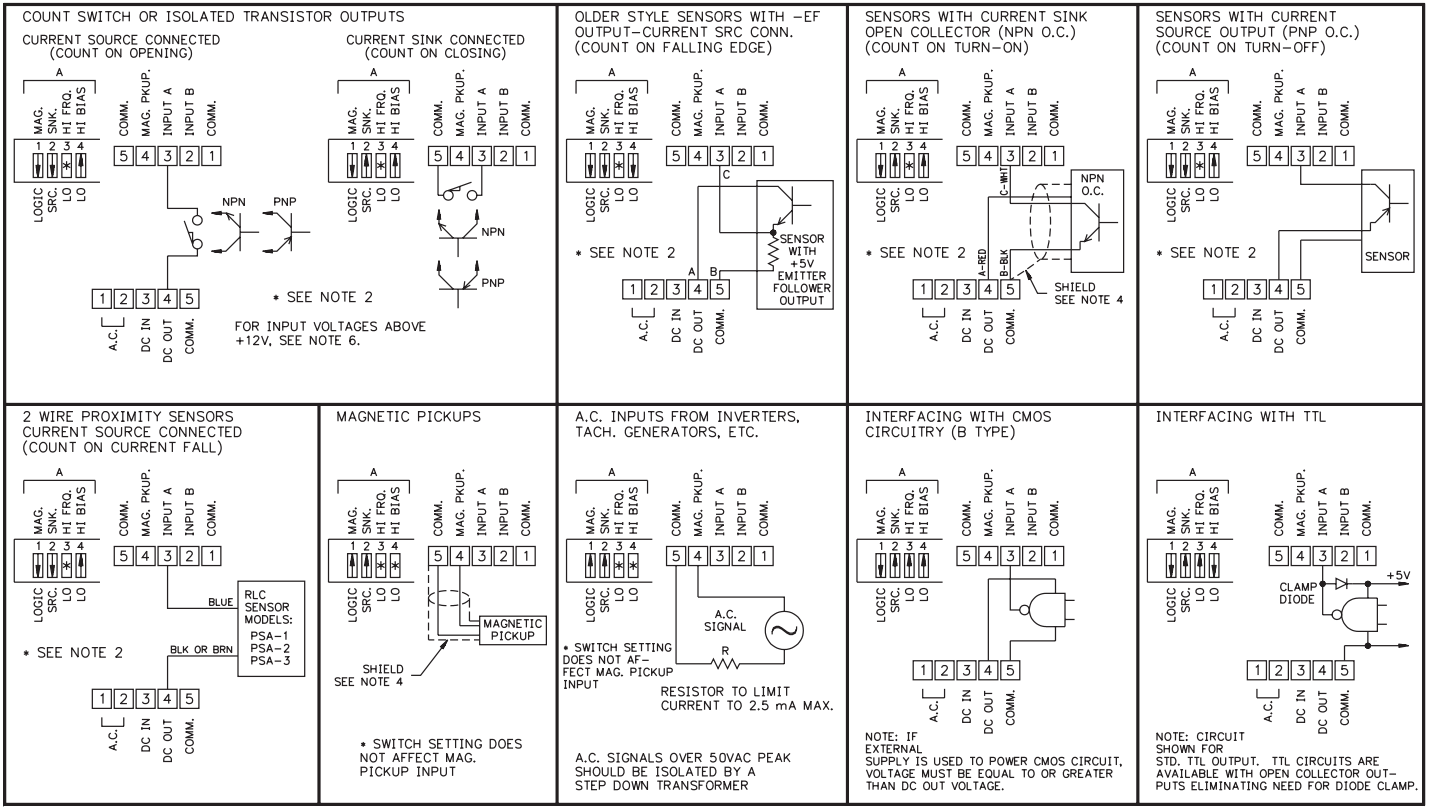
To install the relay board, locate the relay opening at the lower right-hand corner, on the back of the Gemini. Pull the tab down while sliding the board into the two slots in the housing. The relay board will seat into the unit, allowing the tab to return to its original position. To remove the relay board, pull down on the tab just enough to allow the relay board to slide out. Grasp the terminal block and pull to remove the board.

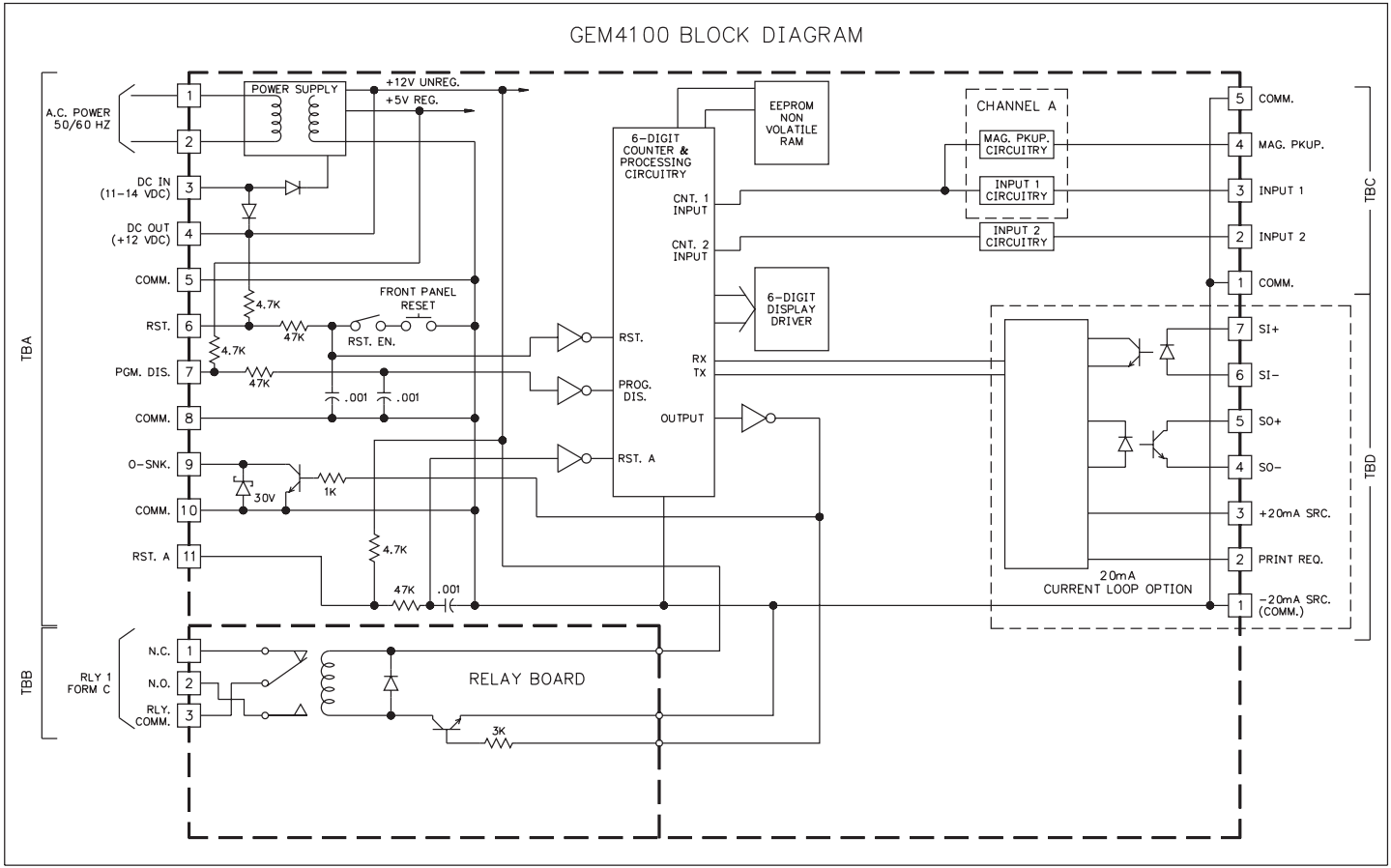


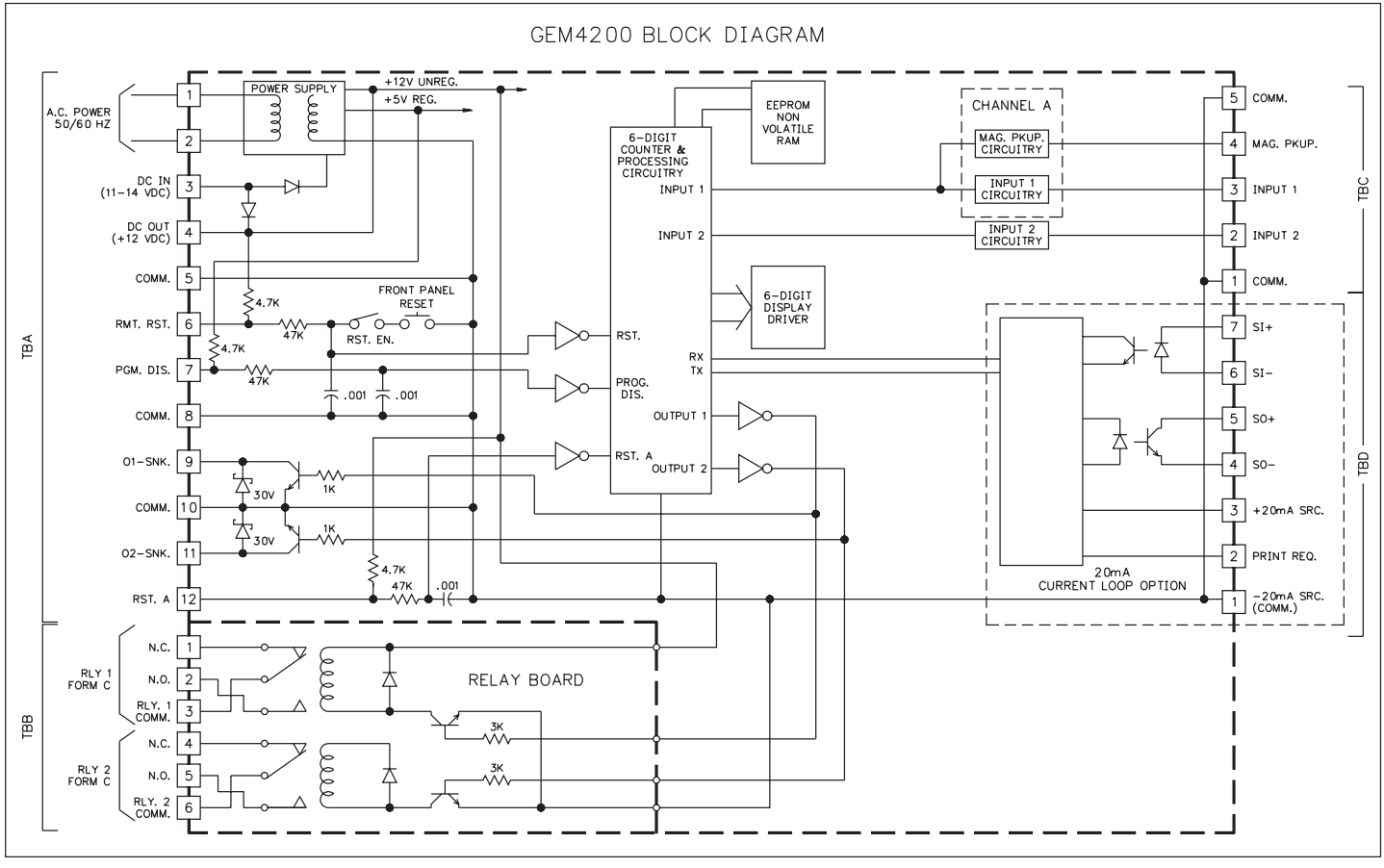
NOTES:

1. *SENSOR VOLTAGE AND CURRENT*
   The +12 V sensor supply voltage on the "DC OUT" terminal is nominal with +/-25% variation due to line and internal load variations. All RLC sensors will accommodate this variation.
2. *HI/LO FRQ SELECTION*
   The HI/LO FRQ selection switch must be set on "LO FRQ" when switch contacts are used to generate count input signals. Since the "LO FRQ" mode also provides very high immunity against electrical noise pickup, it is recommended that this mode also be used, whenever possible, with electronic sensor outputs. The "LO FRQ" mode can be used with any type of sensor output, provided count pulse widths never decrease below 5 msec, and the count rate does not exceed 100 cps.
3. *V_{IL} and V_{IH} levels given are nominal values +/-10% when counter voltage on "DC OUT" terminal is +12 VDC. These nominal values will vary in proportion to the variations in the "DC OUT" terminal voltage, which are caused by line voltage and load changes.*
4. *When shielded cable is used, the shield should be connected to "COMM." at the counter and left unconnected at the sensor end.*
5. *Inputs 1 and 2 can accept source pulses from other circuits up to +28 V in amplitude. For voltages above +28 V, a limiting resistor and zener diode should be used to limit the voltage at the input.*

CONNECTIONS & CONFIGURATION SWITCH SET-UPS FOR VARIOUS SENSOR OUTPUTS (See Note 5)




GEM4100 BLOCK DIAGRAM
A.C. POWER 50/60 HZ
POWER SUPPLY
+12V UNREG.
+5V REG.
DC IN (11-14 VDC)
DC OUT (+12 VDC)
COMM.
RST.
PGM. DIS.
COMM.
O-SNK.
COMM.
RST. A
4.7K
47K
FRONT PANEL RESET
RST. EN.
.001
30V
1K
6-DIGIT COUNTER & PROCESSING CIRCUITRY
EEPROM NON VOLATILE RAM
CNT. 1 INPUT
CNT. 2 INPUT
6-DIGIT DISPLAY DRIVER
RST.
PROG. DIS.
OUTPUT
RST. A
RX
TX
CHANNEL A
MAG. PKUP. CIRCUITRY
INPUT 1 CIRCUITRY
INPUT 2 CIRCUITRY
COMM.
MAG. PKUP.
INPUT 1
INPUT 2
COMM.
SI+
SI-
SO+
SO-
+20mA SRC.
PRINT REQ.
-20mA SRC. (COMM.)
20mA CURRENT LOOP OPTION
TBA
TBB
TBC
TBD
RLY 1 FORM C
N.C.
N.O.
RLY. COMM.
RELAY BOARD
3K


GEM4200 BLOCK DIAGRAM
TBA
TBB
TBC
TBD
A.C. POWER 50/60 HZ
DC IN (11–14 VDC)
DC OUT (+12 VDC)
COMM.
RMT. RST.
PGM. DIS.
COMM.
O1–SNK.
COMM.
O2–SNK.
RST. A
POWER SUPPLY
+12V UNREG.
+5V REG.
4.7K
47K
FRONT PANEL RESET
RST. EN.
.001
30V
1K
RELAY BOARD
RLY 1 FORM C
N.C.
N.O.
RLY. 1 COMM.
RLY 2 FORM C
RLY. 2 COMM.
3K
6–DIGIT COUNTER & PROCESSING CIRCUITRY
INPUT 1
INPUT 2
RST.
PROG. DIS.
OUTPUT 1
RST. A
OUTPUT 2
EEPROM NON VOLATILE RAM
6–DIGIT DISPLAY DRIVER
RX
TX
CHANNEL A
MAG. PKUP. CIRCUITRY
INPUT 1 CIRCUITRY
INPUT 2 CIRCUITRY
20mA CURRENT LOOP OPTION
COMM.
MAG. PKUP.
INPUT 1
INPUT 2
COMM.
SI+
SI–
SO+
SO–
+20mA SRC.
PRINT REQ.
–20mA SRC. (COMM.)

SENSOR INPUT CONNECTIONS & INPUT CONFIGURATION SWITCH SET-UP

The accompanying diagram shows the details of Input 1, Input 2, and Magnetic Pickup circuit. The schematic circuit for Input 2 is almost identical to that of Input 1, with the exception that Input 2 does not have the Magnetic Pickup circuitry paralleled with it. The four switches used to set up Input 1 and the Magnetic Pickup are designated S1, S2, S3, and S4. To set up Input 2, use switches S5, S6, and S7. The functions of these switches are as follows:

CHANNEL A

S1 - MAG: Enables the Magnetic Pickup terminal to be used.
LOGIC: Disables the Magnetic Pickup Input.
Note: SWITCH S2 MUST BE IN THE "SNK" POSITION FOR MAGNETIC PICKUP OPERATION.

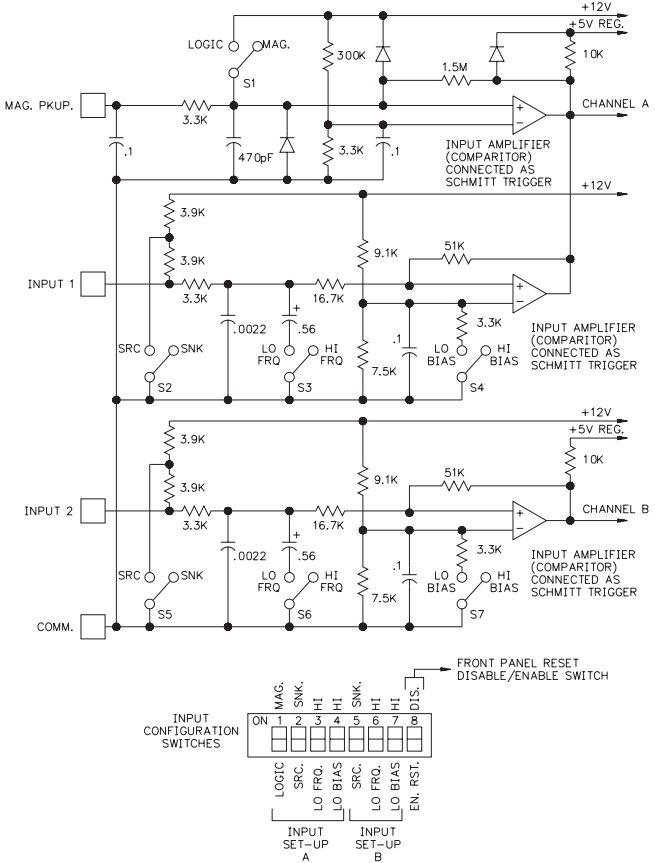
S2 - SNK: Provides a 7.8 K pull-up resistor for sensors with current sinking outputs.
SRC: Provides a 3.9 K pull-down resistor for sensors with current sourcing outputs.

S3 - HI FRQ: Removes damping capacitor and allows operation up to the max. count frequency. Min. count ON or OFF time - 50 usec (U/D or INH.), 50% Duty Cycle (all other "Inputs A & B Response Modes").
LO FRQ: Connects damping capacitor for switch contact debounce. Limits count speed to 100 cps max. Min. count pulse ON or OFF time - 5 msec. (See Note 2, Page 42.)

S4 - HI BIAS: Sets input trigger levels at mid-range to accept outputs from 2-wire proximity sensors, resistive photo-cells, and logic pulses with full 0 to +12 V swings. (V_{IL} = 5.5V, V_{IH} = 7.5 V, See Note 3, Page 42.)
LO BIAS: Sets input trigger levels to the low range to accept logic pulses with 0 to 5 V swings. (V_{IL} = 1.5V, V_{IH} = 3.75 V, See Note 3, Page 42.)

CHAN. B

S5 - Same as S2, for Input 2.
S6 - Same as S3, for Input 2.
S7 - Same as S4, for Input 2.
S8 - DIS. RST.: Disables front panel Reset button, "R".
EN. RST.: Enables front panel Reset button "R", if "Operator Accessible Functions" mode (code 66) has reset enabled.



APPENDIX "B" - SPECIFICATIONS & DIMENSIONS

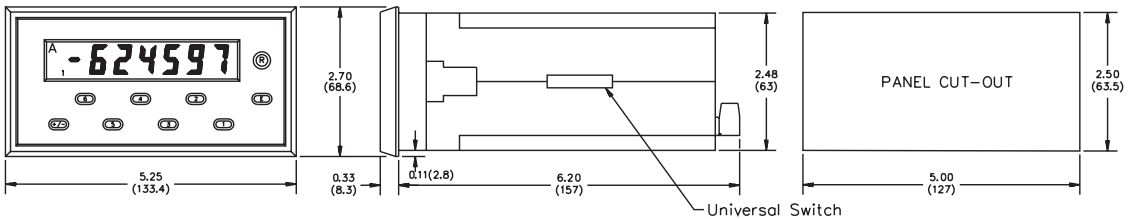
1. **DISPLAY:** 6-digit 0.56" (14.2 mm) High LED display.
2. **POWER REQUIREMENTS:**
   AC Versions
   AC Power: Switch selectable 115/230 VAC (±10%), 50/60 Hz, 20 VA
   DC Power: 11 to 14 VDC @ 0.7 amp maximum
3. **SENSOR POWER:** +12 VDC (±25%) @ 100 mA.
4. **MEMORY:** Non-volatile E^2PROM memory retains all programming information and count values (except Counter Load values) when power is removed or interrupted.
   Power Cycles (ON/OFF): 100,000 minimum
   Data Retention: 10 yrs. minimum
5. **INPUTS 1 AND 2:** Switch selectable to accept count pulses from a variety of sources including switch contacts, outputs from CMOS or TTL circuits, and all standard RLC sensors.
   Current Sourcing - Unit provides pull-down resistor for sensor with current sourcing outputs. (Max. input voltage = 28 VDC @ 7 mA.)
   Current Sinking - Unit provides pull-up resistor for sensors with current sinking outputs. (Max. sensor current = 1.6 mA.)
   Debounce - Damping capacitor provided for switch contact debounce. Limits count speed to 100 Hz maximum and input pulse widths to 5 msec. minimum.
   Lo Bias - Input trigger levels V_{IL} = 1.5 V, V_{IH} = 3.75 V
   Hi Bias - Input trigger levels V_{IL} = 5.5 V, V_{IH} = 7.5 V
   Note: Bias levels given are ±10% @ 12 VDC. They vary proportionally with sensor supply voltage at "DC OUT" terminal.
6. **MAGNETIC PICKUP INPUT:**
   Sensitivity: 150 mV peak (typical @ 12 VDC)
   Hysteresis: 100 mV
   Input impedance: 26.5 KΩ @ 60 Hz
   Maximum Input Voltage: ±50 Vp
7. **RATE ACCURACY AND REPEATABILITY:** +0.012%
8. **RATE MINIMUM INPUT FREQUENCY:** 0.03 Hz
   Note: At frequencies below 0.03 Hz (1 pulse every 32 sec.) the rate display will go to zero.
9. **CONTROL INPUTS:**
   Reset - Active low (V_{IL} = 1.5 V max.), internally pulled up to +12 VDC (I_{SNK} = 3 mA), activation and de-activation response time = 10 msec.
   Program Disable - Active low (V_{IL} = 1.5 V max.), internally pulled up to +5 VDC (I_{SNK} = 1 mA).
   Print Request - (Serial Communications) Active low, (V_{IL} = 1.5 V max.), internally pulled up to +5 VDC (I_{SNK} = 1 mA).
10. **MAXIMUM COUNT RATES:**

COUNTER/RATE MODE [41 1]

MODE	X1	X2	X4
Uni or Bi-directional	10 KHz	5 KHz	
Anti-Coincidence Add/Subtract	4 KHz	2.5 KHz	
Separate Input	8 KHz	4 KHz	
Quadrature	5 KHz	4.5 KHz	2.5 KHz

DIMENSIONS In inches (mm)

NOTE: Mounted units require a clearance of 6.8" (W) behind the panel.



DUAL COUNTER MODE [41 2]			
MODE	X1	X2	X4
Uni or Bi-directional	9 KHz	4.5 KHz	
Anti-Coincidence Add/Subtract	5 KHz	2.5 KHz	
Separate Input	7.5 KHz	3.5 KHz	
Quadrature	4.5 KHz	4 KHz	2.5 KHz

11. **SERIAL COMMUNICATIONS:**

Type - Bi-directional 20 mA current loop, 20 mA source provided. (Powers up to 7 units in a loop with internal current source.)

Baud Rate - Programmable 300 to 2400.

Maximum Address - 16 units. *(Actual number in a single loop is limited by serial hardware specifications.)*

Data Format - 10 bit frame, Odd parity *(one start bit, 7 data bits, one odd parity bit, and one stop bit.)*

Serial Hardware Specifications -

SO - Output Transistor Rating: V_{max} = 30 VDC, V_{SAT} = 1 V_{max} at 20 mA

SI - Input Diode Rating: V_F = 1.25 V_{TYP}; 1.5 V_{max}

Note: The compliance voltage rating of the source must be greater than the sum of the voltage drops around the loop.

12. **OUTPUT(S):**

Solid-State - Current sinking NPN open collector transistors. I_{SNK} = 100 mA max. @ V_{CE} = 1 V. V_{OH} = 30 VDC max. (Internal Zener diode protection).

Relays - Mounted on a field replaceable PC board. Form C contacts rated at 5 amps @ 120/240 VAC or 28 VDC (resistive load), 1/8 H.P. @ 120 VAC (inductive load). The operate time is 5 msec nominal and the release time is 3 msec nominal.

Relay Life Expectancy - 100,000 cycles at Max. Rating. *(As load level decreases, life expectancy increases.)*

Programmable Timed Outputs - The timed outputs can be set from 0.01 to 599.99 seconds, ±(0.01% + 10 msec.).

13. **CERTIFICATIONS AND COMPLIANCES:**

SAFETY

IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.

IP65 Enclosure rating (Face only), IEC 529

Type 4 Enclosure rating (Face only), UL50

ELECTROMAGNETIC COMPATIBILITY:

Immunity to EN 50082-2		
Electrostatic discharge	EN 61000-4-2	Level 2; 4 Kv contact [1] Level 3; 8 Kv air
Electromagnetic RF fields	EN 61000-4-3	Level 3; 10 V/m 80 MHz - 1 GHz
Fast transients (burst)	EN 61000-4-4	Level 4; 2 Kv I/O Level 3; 2 Kv power [2]
RF conducted interference	EN 61000-4-6	Level 3; 10 V/rms 150 KHz - 80 MHz
Power frequency magnetic fields	EN 61000-4-8	Level 4; 30 A/m
Emissions to EN 50081-2		
RF interference	EN 55011	Enclosure class A Power mains class A

Notes:

1. Metal bezel of unit connected with ground from rear bezel screw to metal mounting panel.

2. When the unit is DC powered, a power line filter (RLC#LFIL0000 or equivalent) was installed, so as not to impair the function of the unit.

Refer to the EMC Compliance Installation section of the manual for additional information.

14. **ENVIRONMENTAL CONDITIONS:**

Operating Temperature: 0 to 50°C

Storage Temperature: -40 to 70°C

Operating and Storage Humidity:

85% max. RH (non-condensing) from 0°C to 50°C.

Altitude: Up to 2000 meters

15. **CONSTRUCTION:**

Metal die-cast bezel, plastic case. This unit is rated for NEMA 4/IP65 indoor use. Installation Category II, Pollution Degree 2

16. **WEIGHT:** 2.1 lbs. (0.9 Kg)

APPENDIX "C" - TROUBLESHOOTING GUIDE

The majority of difficulties arising with the Gemini are related to incorrect hook-up and programming set-up. Always check all connections, function codes, Scale Factors, and preset as a first step in troubleshooting.

Before applying power, double check all wiring. Improper AC voltage or AC connections may result in permanent damage to the unit.

For further technical assistance, contact technical support at the appropriate company numbers listed on the back of this instruction manual.

PROBLEM	*POSSIBLE CAUSE*	*REMEDIES*
NO DISPLAY	1. Power off, improperly connected, or power brown-out.	1. Check all wiring, verify power.
P ON DISPLAY	1. Data error on power-up.	1a. Press "E" key. b. Check all function codes.
E ON THE DISPLAY	1. Data error detected by processor.	1a. Press "E" or "R" button. b. Check all function codes. c. Check signal lines for possible noise sources.
NO RESPONSE TO FRONT PANEL	1. Panel disabled.	1. Consult manual on "Operator Accessible Functions" modes.
UNIT DOES NOT COUNT	1. No input. 2. Input selected incorrectly. 3. Count inhibited. 4. Scale factor/multiplier too small.	1. Check sensors/connections. 2. Check rear panel DIP switches. 3. Check function code 43, "Input 1 and 2 Response" modes. 4. Check scale factor value and scale multiplier values.
UNIT WILL NOT ACCEPT THE DESIRED PRESET	1. When counter scale factors greater than 1 are used, the preset value must be evenly divisible by the scale factor.	1. Unit automatically adjusts preset to be evenly divisible by the scale factor.

APPENDIX "C" - TROUBLESHOOTING GUIDE (Cont'd)

PROBLEM	*POSSIBLE CAUSE*	*REMEDIES*
UNIT COUNTS INCORRECTLY	1. Input type incorrectly selected. 2. Inputs incorrectly connected or loose connections. 3. Electrical interference. 4. Wrong counting mode. 5. Scale factor incorrect.	1. Check rear panel DIP switches. Turn on LO FRQ. switch for count speed of less than 100 cps. 2. Check sensors/input connections. 3. Check connections and wiring for noise sources. 4. Verify functions and modes. 5. Change scale factor value.
UNIT WILL NOT RESET	1. Front panel reset disabled. 2. Reset disabled.	1. Check rear panel DIP switch. 2. Check function code 42 or 66.
DATA VALUES AND FUNCTIONS WILL NOT CHANGE OR NOT RECORDED	1. Front panel locked out. 2. Incorrect programming procedure ("E" not pressed).	1. Consult manual on "Operator Accessible Functions" mode (66). 2. Consult section on programming functions in sequential order.
UNIT COUNTS WHILE RESET IS ACTIVATED	1. Reset mode set for "momentary reset".	1. Change reset mode to "Maintained" reset (56).

APPENDIX "D" - GEMINI COUNTER/RATE MODE FUNCTION COMMAND CODE SUMMARY

CODE	MODE	DESCRIPTION	COMMENTS
41		UNIT PERSONALITY	(-)Loads factory set code values*
	+/-1	Counter/Rate*	Rate Display → value (A)/Counter → Display value (B)
42		RESET BUTTON & TERMINAL ACTUATION MODES	
	1	Reset Rate Output	For Rate, reset only affects the output and does not change the displayed value. For Counter, reset affects the output as well as the count value
	2	Reset Counter	
	3	Reset Rate Output & Counter	
43		INPUTS 1 & 2 RESPONSE MODES	
	1	Count with Inhibit	Input 1 = Cnt & Rate, Input 2 = Inh for Cnt.
	2	Count with Up/Down Control	Input 1 = Cnt & Rate, Input 2 = Up/Dn for Cnt
	3	Add/Subtract	Input 1 = Add & Rate, Input 2 = Subtract
	4	Separate Inputs	Input 1 = Rate, Input 2 = Counter
	5	Quadrature	Input 1 = Cnt & Rate, Input 2 = Quadrature
	6	Quadrature x4	Input 1 = Cnt, Quad, & Rate, Input 2 = Cnt & Quad
44		COUNTER NUMBER OF COUNT EDGES	Cannot be programmed in Quad x4.
	1	Single Edge Counting (x1)	Count on falling edge of count input
	2	Double Edge Counting (x2)	Count on both edges of count input.
45		COUNTER SCALE MULTIPLIER	
	1	1	
	2	0.1	
	3	0.01	
	4	0.001	
46		CNTR DECIMAL POINT & LEAD ZERO BLANKING	
	-	(+) Leading Zero Blanking Enabled	
	-	(-) Leading Zero Blanking Disabled	*
	+/-1	No Decimal Point	
	+/-2	Decimal Point Right of Digit 2	
	+/-3	Decimal Point Right of Digit 3	
	+/-4	Decimal Point Right of Digit 4	
	+/-5	Decimal Point Right of Digit 5	
	+/-6	Decimal Point Right of Digit 6	

** Polarity sign is displayed in front of the identifier, a (-) sign is displayed, a (+) sign is not.*

APPENDIX "D" - GEMINI COUNTER/RATE MODE FUNCTION COMMAND CODE SUMMARY

CODE	MODE	DESCRIPTION	COMMENTS
51		OUTPUT ASSIGNMENT (+) Preset Tracking Disabled	
		(-) Preset Tracking Enabled	Preset 1 tracks Preset 2
	+/-1	Output 1 to Rate A, Output 2 to Counter B	
	+/-2	Outputs 1 & 2 to Counter B	
	+/-3	Outputs 1 & 2 to Rate A	Automatically selects code [56,1].
52		OUTPUT 1 TERMINATION MODES	
		(+) Normal Phase	Output normally "OFF", turns "ON" at preset.
		(-) Reverse Phase*	Output normally "ON", turns "OFF" at preset.
	+/-1	Terminate at Output 2 Start (Gemini 4200 only)	Only available when [51 2]
	+/-2	Terminate at Output 2 End (Gemini 4200 only)	Only available when [51 2]
	+/-3	Terminate at Manual Reset	
	+/-4	Terminate at Manual Reset End	
	+/-5	Terminate after Timed Output 1	
	+/-6	Boundary	
53		TIMED OUTPUT 1 VALUE	Range 0.01 to 599.99 sec.
54		GEMINI 4200 OUTPUT 2 TERMINATION MODES	
		(+) Normal Phase	Output normally "OFF", turns "ON" at preset.
		(-) Reverse Phase*	Output normally "ON", turns "OFF" at preset.
	+/-1	Terminate at Output 1 Start	Only available when [51 2]
	+/-2	Terminate at Output 1 End	Only available when [51 2]
	+/-3	Terminate at Manual Reset	
	+/-4	Terminate at Manual Reset End	
	+/-5	Terminate after Timed Output 2	
	+/-6	Boundary	Automatically selects code [56 1]
55		GEMINI 4200 TIMED OUTPUT 2 VALUE	Range 0.01 to 599.99 sec.
56		COUNTER RESET MODES	
		(+) Maintained	Unit remains reset as long as reset is activated.
		(-) Momentary*	Unit will reset instantly and will start counting again even if reset is still activated.

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APPENDIX "D" - GEMINI COUNTER/RATE MODE FUNCTION COMMAND CODE SUMMARY

CODE	MODE	DESCRIPTION	COMMENTS
56		COUNTER RESET MODES (Cont'd)	
	+/-1	Manual Reset to Zero	Automatically selected when outputs are configured for rate [51 3] or when boundary mode is used [54 6].
	+/-2	Manual Reset to Preset**	
	+/-3	Automatically Reset to Zero after Timed Output**	
	+/-4	Automatically Reset to Preset after Timed Output**	
	+/-5	Automatically Reset to Zero at Preset**	Counter resets as soon as Output is activated.**
	+/-6	Automatically Reset to Preset at Zero**	
61		RATE RIGHT-HAND DUMMY ZEROS	
	1	1 Dummy Zero	
	2	2 Dummy Zeros	
	3	3 Dummy Zeros	
	4	No Dummy Zeros	
62		RATE CONVERSION FACTOR	
	1	Rate Per Second (x1)	
	2	Rate Per Minute (x60)	
	3	Rate Per Hour (x3600)	
63		RATE MINIMUM UPDATE TIME	
	1	0.5 Sec minimum/1 Sec maximum	
	2	1 Sec minimum/2 Secs maximum	
	3	2 Secs minimum/4 Secs maximum	
	4	4 Secs minimum/8 Secs maximum	
	5	8 Secs minimum/16 Secs maximum	Maximum rate = 7500 cps
	6	16 Secs minimum/32 Secs maximum	Maximum rate = 3250 cps
64		RATE SCALE MULTIPLIER	
	1	1000	
	2	100	
	3	10	
	4	1	

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*** For the Gemini 4200, all reset to preset modes reset to preset 2 and Timed Output refers to Output 2.*

APPENDIX "D" - GEMINI COUNTER/RATE MODE FUNCTION COMMAND CODE SUMMARY

CODE	MODE	DESCRIPTION	COMMENTS
64		RATE SCALE MULTIPLIER (Cont'd)	
	5	0.1	
	6	0.01	
65		RATE DECIMAL POINT & LEAD ZERO BLANKING	
		(+) Leading Zero Blanking Enabled	
		(-) Leading Zero Blanking Disabled*	
	+/-1	No Decimal Point	
	+/-2	Decimal Point Right of Digit 2	
	+/-3	Decimal Point Right of Digit 3	
	+/-4	Decimal Point Right of Digit 4	
	+/-5	Decimal Point Right of Digit 5	
	+/-6	Decimal Point Right of Digit 6	
66		"OPERATOR ACCESSIBLE FUNCTIONS" MODES	"PGM DIS" Terminal connected to "Comm"
		(+) Reset Button & "RST" Terminal Enabled	Front panel reset can be independently disabled by using DIP switch.
		(-) Reset Button & "RST" Terminal Disabled*	This mode has no affect on the "RST A" terminal which is always enabled.
	+/-1		No Functions Enabled
	+/-2		Preset Programming Enabled
	+/-3		Scale Factor Programming Enabled
	+/-4		Preset & Scale Factor Programming Enabled
	+/-5		Preset & Counter Load Programming Enabled
	+/-6		Preset, Scale Factor & Counter Load Programming Enabled
1	PRESET 1		Up to +/-999999
2	PRESET 2		Up to +/-999999
3	Display A	RATE SCALE FACTOR	Up to 5.9999
3	Display B	COUNTER SCALE FACTOR	Up to +/-5.9999
E & +/-	Display B	COUNTER LOAD VALUE	Up to +/-999999. Counter load value is NOT saved in memory when power is removed.

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APPENDIX "D" - GEMINI DUAL COUNTER MODE FUNCTION COMMAND CODE SUMMARY

CODE	MODE	DESCRIPTION	COMMENTS
41		UNIT PERSONALITY	(-)Loads factory set code values*
	+/-2	Dual Counter*	Counter A→Display value (A)/Counter B→Display value (B)
42		RESET BUTTON & TERMINAL ACTUATION MODES	
	1	Reset Counter A	Reset affects the outputs as well as the displayed value.
	2	Reset Counter B	
	3	Reset Counter A & B	
43		INPUTS 1 & 2 RESPONSE MODES	
	1	Count With Inhibit	Input 1 = Cnt A & Cnt B, Input 2 = Inh.
	2	Count With Up/Down Control	Input 1 = Cnt A & Cnt B, Input 2 = Up/Dn.
	3	Add/Subtract	Input 1 = Add, Input 2 = Subtract
	4	Separate Inputs	Input 1 = Counter A, Input 2 = Counter B
	5	Quadrature	Input 1 = Cnt A & Cnt B, Input 2 = Quadrature
	6	Quadrature x4	Input 1 = Cnt & Quad, Input 2 = Cnt & Quad.
44		COUNTER A & B NUMBER OF COUNT EDGES	Cannot be programmed in quadrature x4.
	1	Single Edge Counting (x1)	Count on falling edge of count input.
	2	Double Edge Counting (x2)	Count on both edges of count input
45		COUNTER B SCALE MULTIPLIER	
	1	1	
	2	0.1	
	3	0.01	
	4	0.001	
46		CNTR B DECIMAL POINT & LEAD ZERO BLANKING	
		(+) Leading Zero Blanking Enabled	
		(-) Leading Zero Blanking Disabled*	
	+/-1	No Decimal Point	
	+/-2	Decimal Point Right of Digit 2	
	+/-3	Decimal Point Right of Digit 3	
	+/-4	Decimal Point Right of Digit 4	
	+/-5	Decimal Point Right of Digit 5	
	+/-6	Decimal Point Right of Digit 6	

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APPENDIX "D" - GEMINI DUAL COUNTER MODE FUNCTION COMMAND CODE SUMMARY

CODE	MODE	DESCRIPTION	COMMENTS
51		OUTPUT ASSIGNMENT	
		(+) Preset Tracking Disabled	
		(-) Preset Tracking Enabled*	Preset 1 tracks Preset 2
	+/-1	Output 1 to Counter A, Output 2 to Counter B	
	+/-2	Outputs 1 & 2 to Counter B	Automatically selects [61_1]
52		OUTPUT 1 TERMINATION MODES	
		(+) Normal Phase	Output normally "OFF", turns "ON" at preset.
		(-) Reverse Phase*	Output normally "ON", turns "OFF" at preset.
	+/-1	Terminate at Output 2 Start (Gemini 4200 only)	Only available when [51_2]
	+/-2	Terminate at Output 2 End (Gemini 4200 only)	Only available when [51_2]
	+/-3	Terminate at Manual Reset	
	+/-4	Terminate at Manual Reset End	
	+/-5	Terminate after Timed Output	
	+/-6	Boundary	Automatically selects code [61_1] if [51_1]
53		TIMED OUTPUT 1 VALUE	Range 0.01 to 599.99 sec.
54		GEMINI 4200 OUTPUT 2 TERMINATION MODES	
		(+) Normal Phase	Output normally "OFF", turns "ON" at preset.
		(-) Reverse Phase*	Output normally "ON", turns "OFF" at preset.
	+/-1	Terminate at Output 1 Start	Only available when [51_2]
	+/-2	Terminate at Output 1 End	Only available when [51_2]
	+/-3	Terminate at Manual Reset	
	+/-4	Terminate at Manual Reset End	
	+/-5	Terminate after Timed Output 2	
	+/-6	Boundary	Automatically selects code [56_1].
55		GEMINI 4200 TIMED OUTPUT 2 VALUE	Range 0.01 to 599.99 sec.
56		COUNTER B RESET MODES	
		(+) Maintained	Unit remains reset as long as reset is activated.
		(-) Momentary*	Unit will reset and start counting again, even if reset is still activated.

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APPENDIX "D" - GEMINI DUAL COUNTER MODE FUNCTION COMMAND CODE SUMMARY

CODE	MODE	DESCRIPTION	COMMENTS
56		COUNTER B RESET MODES (Cont'd)	
	+/-1	Manual Reset to Zero	Automatically selected when boundary mode is used [52,6].
	+/-2	Manual Reset to Preset**	
	+/-3	Automatically Reset to Zero after Timed Output**	
	+/-4	Automatically Reset to Preset after Timed Output**	
	+/-5	Automatically Reset to Zero at Preset**	Counter resets as soon as Output is activated.**
	+/-6	Automatically Reset to Preset at Zero**	
61		COUNTER A RESET MODES	
		(+) Maintained	Unit remains reset as long as reset is activated.
		(-) Momentary*	Unit will reset and start counting again, even if reset is still activated.
	+/-1	Manual Reset to Zero	Automatically selected when boundary mode is used [52,6].
	+/-2	Manual Reset to Preset 1	
	+/-3	Automatically Reset to Zero after Timed Output 1	
	+/-4	Automatically Reset to Preset 1 after Timed Output 1	
	+/-5	Automatically Reset to Zero at Preset 1	Counter resets as soon as Output 1 is activated.
	+/-6	Automatically Reset to Preset 1 at Zero	
64		COUNTER A SCALE MULTIPLIER	
	1	1	
	2	0.1	
	3	0.01	
	4	0.001	

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*** For the Gemini 4200, all reset to preset modes reset to preset 2 and Timed Output refers to Output 2.*

APPENDIX "D" - GEMINI DUAL COUNTER MODE FUNCTION COMMAND CODE SUMMARY

CODE	MODE	DESCRIPTION	COMMENTS
65		CNTR A DECIMAL POINT & LEAD ZERO BLANKING	
		(+) Leading Zero Blanking Enabled	
		(-) Leading Zero Blanking Disabled*	
	+/-1	No Decimal Point	
	+/-2	Decimal Point Right of Digit 2	
	+/-3	Decimal Point Right of Digit 3	
	+/-4	Decimal Point Right of Digit 4	
	+/-5	Decimal Point Right of Digit 5	
	+/-6	Decimal Point Right of Digit 6	
66		"OPERATOR ACCESSIBLE FUNCTIONS" MODES	"PGM DIS" Terminal connected to "Comm"
		(+) Reset Button & "RST" Terminal Enabled	Front panel reset can be independently disabled by using DIP switch.
		(-) Reset Button & "RST" Terminal Disabled*	This mode has no affect on the "RST A" terminal which is always enabled.
	+/-1	No Functions Enabled	
	+/-2	Preset Programming Enabled	
	+/-3	Scale Factor Programming Enabled	
	+/-4	Preset & Scale Factor Programming Enabled	
	+/-5	Preset & Counter Load Programming Enabled	
	+/-6	Preset, Scale Factor & Cnter Load Programming Enabled	
1		PRESET 1	Up to +/-999999
2		PRESET 2	Up to +/-999999
3	Display A	COUNTER A SCALE FACTOR	Up to +/-5.9999
3	Display B	COUNTER B SCALE FACTOR	Up to +/-5.9999
E & +/-	Display A	COUNTER A COUNTER LOAD VALUE	Up to +/-999999. Counter Load value is NOT saved in memory when power is removed.
E & +/-	Display B	COUNTER B COUNTER LOAD VALUE	Up to +/-999999. Counter Load value is NOT saved in memory when power is removed.

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APPENDIX "E" - SCALING FOR COUNTING

The Gemini is factory set to provide 1 count on the display for each pulse that is input to the unit. In many applications, there will not be a one to one correspondence between input pulses and display units. In these applications it will be necessary for the Gemini to scale or multiply the input pulses by a scaling factor to achieve the proper display units (feet, meters, gallons, widgets, etc.). There are three different function codes that are used in scaling the input pulses to the desired reading. They are: the "Counter Scale Factor", the "Counter Scale Multiplier", and the "Counter Number of Count Edges". All three are factored together to provide the Total Scaling that is necessary.

This section applies to Counter A (if Dual Counter personality) and Counter B. There are separate Scale Factors and Scale Multipliers associated with each counter.

The "Number of Count Edges", function code 44 or code 43 (Quad x4), will apply to both counters. In other words, if one counter requires that 2 count edges be used per input pulse, programming that mode will cause both counters to use both count edges. In the Quadrature x4, Inputs 1 & 2 Response mode, both the rising and falling edges of both Inputs, 1 & 2, are counted. In this mode the "Number of Count Edges" is 4.

The first step in scaling the counter requires that the "Number of Pulses" per "Display Unit" or "Display Units" be obtained. This may require a small amount of deductive reasoning. For example: A 48 tooth gear is mounted to a 2 ft circumference feed roll in a paper processing plant. It is desired to totalize the total footage of paper processed. In this example the units of display will be in feet. A sensor sensing the gear teeth will provide 48 pulses for each revolution of the feed roll. Each revolution will equate to a linear distance of 2 feet. The number of "Display Units" will be 2. The "Number of Pulses" per "Display Units" (2 feet) would naturally be 48.

Once the number of "Display Units" and the "Number of Pulses" have been obtained, the Total Scaling Factor can be calculated.

The "Total Scaling Factor", denoted as "K_T", is simply the total amount of scaling required. It is obtained by dividing the "Display Units" by the "Number of Pulses" as shown in Formula #1 below.

FORMULA #1: K_T = Display Units/Number of Pulses

WHERE:

DISPLAY UNITS - The number of units (revolutions, feet, 10ths of feet, meters, etc.) that would be acquired after the "Number of Pulses" has occurred.

NUMBER OF PULSES - The Number of pulses required to achieve the number of "Display Units".

For the preceding example, the Total Scaling Factor, "K_T", is calculated by plugging in 2 and 48 in the formula. K_T = Display Units/Number of Pulses = 2/48 = 0.041667.

As previously stated, the Total Scaling Factor, "K_T", is the combination of the Scale Factor, Scale Multiplier, and Number of Count edges. In many applications the Total Scale Factor, "K_T", can be programmed directly into the Scale Factor, the Scale Multiplier and Number of Count Edges factory settings, of x1, would be used.

In some applications, more display resolution may be required. Whenever the Total Scaling Factor is greater than 1.0000 and when utilizing only one edge per count pulse, there may not be enough display resolution. For example; with a Total Scaling Factor of 2.000, when an input pulse is generated, the display will increment by 2. If the display units is in feet, when 3 feet has gone by, the display will still only read 2. It will not increment again until 4 feet has been accumulated. With this amount of display resolution it would be impossible to set the Preset and have the output respond at odd feet intervals (1, 3, 5, etc.). To increase resolution, the Number of Count edges will have to be increased. This can be achieved by programming Function code 44 to mode 2, 2 edges, or Function code 43 to mode 6, Quad x4, if quadrature counting is being used.

If enough resolution still has not been attained, more input pulses will need to be generated per display unit.

The amount of resolution required will vary depending on the particular application. In cut-to-length applications, a high amount of resolution is often necessary. However, in totalizing applications, display resolution may not be important. It should be noted that whenever the number of count edges is increased to 2 or 4 (Quad x4), the maximum count frequency will decrease. (See Appendix "B" for maximum count frequency specification.)

Note: When using 2 or 4 edge counting for length sensor, on/off duty cycle must be 50% to maintain max. accuracy (mag. pickup will not work).

Once the Number of Count Edges (NCE) to be used has been determined, the Remaining Scaling factor required, "K_R", can be calculated. This is simply the Total Scaling Factor, "K_T", divided by the Number of Count edges.

FORMULA #2: $K_R = K_T/NCE$

WHERE: K_R - Remaining Scaling required

In our original example, the Total Scaling Factor, "K_T" was determined to be 0.041667. Since this value is less than one, sufficient pulse information is being generated, i.e., there is enough resolution for the units selected. The Number of Count edges can be left at the factory set value of 1. The Total Scaling Factor, "K_T", effectively becomes the Total Scaling Remaining, "K_R". ($K_R = 0.041667/1 = 0.041667$)

If the scaling remaining is between 0.6000 and 5.9999, it can be programmed directly into the Scale Factor value and the x1 factory setting for the Scale Multiplier, "SCM", can be used.

The general rule for choosing an SCM value is, when the Remaining Scaling Required, "K_R", is less than 0.6000, an SCM value of 0.1 or 0.01 can be used to get a Scale Factor value between 0.6 and 5.9999 or to the point where the maximum number of significant digits is obtained.

FORMULA #3: $SF = K_R/SCM$

Following our continuing example, it is easy to see that the Scaling Remaining, "K_R" (0.041667), cannot fit into the Scale Factor Value without losing significant digits. Using the Formula above and a Scale Multiplier value of 0.01, will allow us to get the maximum number of significant digits possible ($SF = K_R/SCM = 0.041667/0.01 = 4.1667$).

COUNTER SCALING EXAMPLE:

EXAMPLE #1:

A flow sensor provides 62 pulses per gallon. Calculate the scaling required to provide a display reading in gallons.

In this example the number of "Display Units" is the same as the desired reading, since there are no decimal points involved.

The number of "Display Units" displayed after 62 pulses have been counted should be 1.

STEP 1 - Calculate the Total Scaling Factor, "K_T", using Formula #1.

K_T = Display Units/Number of Pulses (Formula #1)

$K_T = 1/62 = 0.016129$

STEP 2 - In this application 62 pulses per gallon provides more than enough resolution, so the "Number of Count Edges" is left set to the factory configured value of 1. With a "NCE" value of 1, the remaining amount of scaling necessary is still 0.016129

$K_R = K_T/NCE$ (Formula #2)

$K_R = 0.016129/1 = 0.016129$

STEP 3 - In order to provide maximum scaling accuracy, a "Scale Multiplier" value is chosen that will give the maximum amount of significant digits in the Scale Factor. A value of 0.01 will result in a Scale Factor Value of 1.6129.

$SF = K_R/SCM$ (Formula #3)

$SF = 0.016129/0.01 = 1.6129$

EXAMPLE #2:

A quadrature Rotary Pulse Generator that provides 100 pulses per revolution is coupled to a feed roll that is 2.5 feet in circumference. It is desired to read in feet with display resolution to the nearest hundredth of feet.

In this application, the requirement is for the display to read in hundredths of a foot. A 2.5 ft. distance will equate to 250 "Display Units" (hundredths). The "Number of Pulses" for 2.5 ft. (250 hundredths) is 100, as stated.

From the information obtained, the Total Scaling Factor, "K_T", can be calculated, using Formula #1.

K_T = Display Units/Number of Pulses

$K_T = 250/100 = 2.5$

With a Total Scaling Factor, "K_T", of 2.5, it can easily be seen that for every pulse that is input, the display will increment by 2.5 display units (hundredths). The application requires resolution to the nearest hundredth of a foot. In order to get higher resolution, Quadrature x4 Input Response Mode is selected. This will provide four times more resolution. Using Formula #2, and 4 for the "Number of Count Edges", the Remaining Scaling, "K_R", is calculated.

$K_R = K_T$/Number of Count Edges

$K_R = 2.5/4 = 0.625$

At this point, it can be seen that the Remaining Scaling value of 0.625 will fit into the Scale Factor value range without losing any significant digits or scaling it any further. Because of this, the Scale Multiplier (SCM) factory set value of x1 is used, and 0.6250 is programmed directly into the Scale Factor, "SF".

$SF = K_R/SCM$

$SF = 0.6250/1 = 0.6250$

APPENDIX "F" - SCALING FOR RATE

The Gemini offers a simplified method for scaling the rate indicator. The method does not require time unit conversions. The desired time format (Rate Per Second, Rate Per Minute, Rate Per Hour) is simply selected as part of the programming procedure.

Due to the way the rate is calculated (See "General Description" section), high resolution and accuracy can be realized at all input rates, slow or fast. It is not necessary to increase the pulse information to obtain higher resolution.

The Rate Minimum Update Time, function code 63, can be increased (from 0.5 sec. up to 16 sec.) to provide averaging in applications where the input pulse spacing is not stable. The Update time selected, however, will not affect the scaling in any manner.

Scaling the Rate channel simply involves programming the Gemini so that pulse units inputted to the unit will be scaled to the desired display units (revolutions, feet, meters, etc.) in the desired time format (Rate Per Second, Rate per Minute, Rate Per Hour).

There are two basic types of rate scaling applications for the Gemini. The first is when the rate indicator is to display the rate at which the counter is counting (count and rate using the same sensor). In this case, the rate indicator can be programmed with the same scaling parameters as the counter. The only other requirement is that the desired "Rate Conversion Factor", function code 62, be selected to provide the rate display in the desired time format, i.e., Rate per Second, Rate per Minute or Rate per Hour. This will automatically scale the rate by x1, x60 or x3600 (1 pulse per second = 60 pulses per minute = 3600 pulses per hour).

Note: If the number of Count Edges for Counter B is 2 or 4, the rate must be scaled by the same amount using the Rate Scale Factor and Scale Multiplier. This is due to the fact that the rate indicator only uses 1 edge.

The second basic type of rate application is when the rate indicator and counter are using two separate sensors. In this case, both the rate and count channels must be scaled separately.

Scaling for the count channel is discussed in Appendix "E" - Scaling for Counter.

In order to scale the rate, it is only necessary to know the number of pulses per display unit or units (feet, revolutions, etc.). For example; if a 48 tooth gear, which is coupled to a shaft, is being sensed and it is desired to indicate the shaft speed in revolutions, the display units would be revolutions. It is obvious that 48 pulses will occur in one revolution.

In order to convert the pulse units to revolutions, it is necessary for the Gemini to multiply the number of pulses by a scaling factor to convert the pulse units to revolution units. The Gemini has two programming codes that serve to scale pulse units to desired display units. They are: the Scale Factor and the Scale Multiplier. Both are used to attain the Total Scaling Factor, "K_T".

To calculate the Total Scaling Factor, "K_T", for the application, the following formula is used.

FORMULA #1: K_T = Display units/Number of pulses

WHERE:

DISPLAY UNITS - The number of units (revolutions, feet, 10ths of feet, meters, etc.) that would be acquired after the "Number of Pulses" has occurred.

NUMBER OF PULSES - The Number of pulses required to achieve the number of "Display Units".

Using the example previously discussed, the display unit would be 1 revolution and the number of pulses per display unit would be 48. Therefore, the Total Scale Factor would be 0.020833 (K_T = Display Units/Number of Pulses = 1 rev/48 pulses per rev = 0.020833). In many applications the Total Scale Factor, "K_T", can be programmed as the Scale Factor, "SF", and the Scale Multiplier, "SCM", factory setting, x1, would be used. However, in some applications, such as the one above, it may be desired to obtain more significant digits in the Scale Factor, "SF".

These situations occur when the "K_T" factor does not calculate to an even number that will be fit into the four decimal places available to the Scale Factor. The following formula can be used to calculate the Scale Factor when an SCM value other than x1 is needed.

FORMULA #2: SF = K_T/SCM

In this formula, the Total Scaling Factor, previously calculated, is divided by the Scale Multiplier Value, "SCM", to obtain the Scale Factor, "SF".

The general rule for choosing an SCM value is, when the Total Scale Factor, "K_T", is less than 0.6000, an SCM value of 0.1 or 0.01 can be used to get a Scale Factor value between 0.6 and 5.9999, or to the point where the maximum number of significant digits is obtained. If the Total Scaling Factor, "K_T", is greater than 5.9999, then an SCM value of 10, 100, or 1000 can be used to obtain a Scale Factor Value between 0.6 and 5.9999.

In our initial example, the Total Scaling Factor, "K_T" was determined to be 0.020833. It is easy to see that this number cannot be programmed into the Scale Factor, "SF", without losing significant digits. Using formula #2 and the general

rules stated above, a Scale Multiplier Value of 0.01 is chosen and the Scale Factor is calculated as shown below. This will provide maximum amount of conversion accuracy possible.

$$SF = K_T/SCM$$
$$SF = 0.020833/SCM$$
$$SF = 0.020833/0.01 = 2.0833$$

In situations where the Total Scale Factor is already in range of the Scale Factor (0.0001 to 5.9999) and when there are no significant digits that are lost, the Total Scaling Factor, "K_T", can be programmed directly into the Scale Factor Value and a Scale Multiplier value of 1 (the factory set value) used. For example; if the display units are in feet and there are 100 pulses per foot, the Total Scaling Factor, "K_T", would be 0.01 (K_T = Display units/pulses per display units = 1 / 100 = 0.01). Since the Total Scaling Factor, "K_T", is exactly 0.01, it can be programmed into the Scale Factor Value, "SF", and the Scale Multiplier Value, "SCM", can be left at, or programmed to, its factory setting of x1.

After the Scale Factor and Scale Multiplier values are selected, all that is necessary to complete the scaling is to choose the Rate Conversion Factor. The Rate Conversion Factor can be selected to provide indication in Rate per Second, Rate Per Minute, or Rate per Hour.

Note: There may be situations where there are many more pulses per display unit than needed. In these situations the minimum SCM value (0.01) may not provide enough significant digits in the Scale Factor. To achieve more significant digits, the Rate Conversion Factor should be set to mode 1, Rate per Second and the following formula be used.

$$SF = \frac{K_T \times CF}{SCM}$$

Where: CF = 60 for display reading in Rate Per Minute, or
CF = 3600 for display reading in Rate Per Hour

RATE SCALING EXAMPLE:

EXAMPLE #1:

A 60 tooth gear is mounted to a roll that has a circumference of 2 feet. It is desired to have a rate readout in 10ths of feet per minute. Calculate the Scale Factor and Scale Multiplier values necessary to provide the desired readout.

In this example one revolution of the web will provide 60 pulses for 2 feet of linear travel. Since the desired display units are to be in tenths of feet, it is necessary to convert 2 feet to tenths, giving us 20 tenths (display units). The Total Scaling Factor, "K_T", is calculated by simply plugging in the two numbers into formula #1.

$$K_T = \text{Display Units/Number of Pulses}$$
$$K_T = 20/60 = 0.333333$$

In order to get the maximum number of significant digits in the Scale Factor we use formula #2 and a Scale Multiplier value of 0.1 as shown below.

$$SF = K_T/SCM \qquad SF = 0.333333/0.1 = 3.3333$$

To obtain rate indication in Feet Per Minute, the Rate Conversion Factor is programmed for Rate per Minute mode. A decimal point is also added to provide for a display of feet in 10ths.

EXAMPLE #2:

The shaft of a positive displacement pump has a 14 tooth sprocket that is being sensed by a magnetic pickup. It is known that when the unit is pumping 810 liters of water per minute, the shaft is turning 400 RPM. It is desired to have a display readout in liters per minute.

With the Gemini, it is not necessary to deal with time unit conversions. From the information given, we know that when the shaft has turned 400 revolutions, 810 liters of water will have been pumped. The first step we need to take, is to calculate the number of pulses that occur when 810 liters have been pumped.

NUMBER OF PULSES = # of Revolutions x Pulses per Rev.
NUMBER OF PULSES = 400 Rev x 14 Pulses per Rev = 5600 pulses.

We now have all the information necessary to scale the rate. The Total Scaling Factor, "K_T", is calculated using Formula #1 as shown below.

$$K_T = \text{Display Units/Number of Pulses}$$
$$K_T = 810/5600 = 0.144643$$

It is noticed that there are more significant digits in the Total Scale Factor, "K_T", than there are available for the Scale Factor, "SF". In order to acquire the maximum amount of significant digits for the Scale Factor, Formula #2 is used and a Scale Multiplier value of 0.1 is selected.

$$SF = K_T/SCM$$
$$SF = 0.144643/0.1 = 1.4464$$

The Scale Factor, "SF", then becomes 1.4464 (1.44643 rounded to 4 decimal places). This provides the maximum amount of conversion accuracy possible.

The final step is to select a Rate Conversion Factor. The Rate Conversion Factor is chosen to be Rate Per Minute as was required.

APPENDIX "G" - GEMINI 4100 COUNTER/RATE PROGRAMMING CHART

FEATURE & MODE SELECTION (See Programming Procedure)

DETAILED MODE MENUS

41 (1) ☆

42 ( )

RESET BUTTON & TERMINAL ACTUATION MODES

(1) RST RATE OUTPUT (2) RST COUNTER (3) RST RATE OUTPUT & COUNTER

43 ( )

INPUTS 1 & 2 RESPONSE MODES

(1) 1 = CNT. & RATE, 2 = INH. (CNT.) (2) 1 = CNT. & RATE, 2 = UP/DN
(3) 1 = CNT. UP & RATE, 2 = CNT. DN. (4) 1 = RATE, 2 = CNT.
(5) QUADRATURE X1 (1 = RATE) (6) QUADRATURE X4 (1 = RATE)

44 ( )

INPUT PULSE EDGES REGISTERING COUNTS (Counter B)*

(1) NEG. GOING EDGES ONLY (1 count/pulse) (2) BOTH + & - EDGES (2 counts/pulse)

* Not accessible with Quadrature X4 Input Response Mode.

45 ( )

COUNTER SCALE MULTIPLIER

(1) x1 (2) x0.1 (3) x0.01 (4) x0.001

46 ( )

COUNTER DECIMAL POINT & LEADING ZERO BLANKING

(1)	0	(-1) 0 0 0 0 0 0 (NO L.Z.B.)
(2)	0.0	(-2) 0 0 0 0 0.0
(3)	0.0 0	(-3) 0 0 0 0.0 0
(4)	0.0 0 0	(-4) 0 0 0.0 0 0
(5)	0.0 0 0 0	(-5) 0 0.0 0 0 0
(6)	0.0 0 0 0 0	(-6) 0.0 0 0 0 0 0

51 ( )

OUTPUT ASSIGNMENT

(2) OUTPUT TO COUNTER (3) OUTPUT TO RATE

OUTPUT TERMINATION MODES

MODE	AT RESET START	AT RESET END	AFTER TIMED OUTPUT	BOUNDARY MODE	OUTPUT NORMALLY "OFF"	OUTPUT NORMALLY "ON"
(3)	●				●	
(-3)	●					●
(4)		●			●	
(-4)		●				●
(5)			●		●	
(-5)			●			●
* (6)				●	●	
(-6)				●		●

52 ( )

*BOUNDARY MODE: Output goes "OFF" when count or rate < Preset and goes "ON" when count or rate is ≥ Preset as the value goes up and down through the Preset.

53 ( )

TIMED OUTPUT VALUE

Timed Output Value range; 0.01 to 599.99 Sec

COUNTER RESET MODES

MODE	RESET TO ZERO	RESET TO PRESET	AUTO RST AFTER TIMED OUT.	AUTO RST AT TIMED OUT.	MAINTAINED MANUAL RST	MOMENTARY MANUAL RST
* (1)	●				●	
* (-1)	●					●
(2)		●			●	
(-2)		●				●
(3)	●		●		●	
(-3)	●		●			●
(4)		●	●		●	
(-4)		●	●			●
(5)	●			●	●	
(-5)	●			●		●
(6)		●		●	●	
(-6)		●		●		●

56 ( )

*Automatically selected when [51 3] or [52 6] is programmed.

61 ( )

RATE RIGHT HAND DUMMY ZEROS

(1) 0 (2) 00 (3) 000 (4) NONE

62 ( )

RATE CONVERSION FACTOR

(1) RATE/SEC (x1) (2) RATE/MINUTE (x60) (3) RATE/HR. (x3600)

63 ( )

RATE MINIMUM UPDATE TIME*

(1) 0.5 Sec (2) 1 Sec (3) 2 Sec
(4) 4 Sec (5) 8 Sec (6) 16 Sec

* Maximum update time varies with each minimum update time.

64 ( )

RATE SCALE MULTIPLIER

(1) x1000 (2) x100 (3) x10 (4) x1 (5) x0.1 (6) x0.01

65 ( )

RATE DECIMAL POINT & LEADING ZERO BLANKING

(1)	0	(-1) 0 0 0 0 0 0 (NO L.Z.B.)
(2)	0.0	(-2) 0 0 0 0 0.0
(3)	0.0 0	(-3) 0 0 0 0.0 0
(4)	0.0 0 0	(-4) 0 0 0.0 0 0
(5)	0.0 0 0 0	(-5) 0 0.0 0 0 0
(6)	0.0 0 0 0 0	(-6) 0.0 0 0 0 0 0

66 ( )

"OPERATOR ACCESSIBLE FUNCTIONS" MODES

(With "PGM. DIS." terminal to "COMM")

MODE	PRESET VALUE	SCALE FACTORS	COUNTER LOAD VALUE	RESET BUTTON &TERMINAL
(1)				●
(-1)				
(2)	●			●
(-2)	●			
(3)		●		●
(-3)		●		
(4)	●	●		●
(-4)	●	●		
(5)	●		●	●
(-5)	●		●	
(6)	●	●	●	●
(-6)	●	●	●	

☆ Entering a [41 -1], at any time will load factory settings for all modes.

APPENDIX "G" - GEMINI 4100 DUAL COUNTER PROGRAMMING CHART

FEATURE & MODE SELECTION (See Programming Procedure)

41 (2) ☆

DETAILED MODE MENUS

42 ( )

RESET BUTTON & TERMINAL ACTUATION MODES

(1) RST COUNTER A (2) RST COUNTER B (3) RST COUNTER A & B

43 ( )

INPUTS 1 & 2 RESPONSE MODES

(1) 1 = CNT. (A & B), 2 = INH. (2) 1 = CNT. (A & B), 2 = UP/DN
(3) 1 = CNT. UP (A & B), 2 = CNT. DN.(A & B) (4) 1 = CNT. A, 2 = CNT. B
(5) QUADRATURE X1 (A & B) (6) QUADRATURE X4 (A & B)

44 ( )

INPUT PULSE EDGES REGISTERING COUNTS (Counter A & B)*

(1) NEG. GOING EDGES ONLY (1 count/pulse) (2) BOTH + & - EDGES (2 counts/pulse)

* Not accessible with Quadrature X4 Input Response Mode.

45 ( )

COUNTER B SCALE MULTIPLIER

(1) x1 (2) x0.1 (3) x0.01 (4) x0.001

46 ( )

COUNTER B DECIMAL POINT & LEADING ZERO BLANKING

(1)	0	(-1)	0 0 0 0 0 0 (NO L.Z.B.)
(2)	0.0	(-2)	0 0 0 0 0.0
(3)	0.0 0	(-3)	0 0 0 0.0 0
(4)	0.0 0 0	(-4)	0 0 0.0 0 0
(5)	0.0 0 0 0	(-5)	0 0.0 0 0 0
(6)	0.0 0 0 0 0	(-6)	0.0 0 0 0 0

51 ( )

OUTPUT ASSIGNMENT

(2) OUTPUT TO COUNTER B

OUTPUT TERMINATION MODES

52 ( )

MODE	AT RESET START	AT RESET END	AFTER TIMED OUTPUT	BOUNDARY MODE	OUTPUT NORMALLY "OFF"	OUTPUT NORMALLY "ON"
(3)	●				●	
(-3)	●					●
(4)		●			●	
(-4)		●				●
(5)			●		●	
(-5)			●			●
* (6)				●	●	
(-6)				●		●

*BOUNDARY MODE: Output goes "OFF" when count or rate < Preset and goes "ON" when count or rate is ≥ Preset as the value goes up and down through the Preset.

53 ( )

TIMED OUTPUT VALUE

Timed output value range; 0.01 to 599.99 Sec

COUNTER B RESET MODES

56 ( )

MODE	RESET TO ZERO	RESET TO PRESET	AUTO RST AFTER TIMED OUT.	AUTO RST AT TIMED OUT.	MAINTAINED MANUAL RST	MOMENTARY MANUAL RST
* (1)	●				●	
* (-1)	●					●
(2)		●			●	
(-2)		●				●
(3)	●		●		●	
(-3)	●		●			●
(4)		●	●		●	
(-4)		●	●			●
(5)	●			●	●	
(-5)	●			●		●
(6)		●		●	●	
(-6)		●		●		●

*Automatically selected when [52 6] is programmed.

61 ( )

COUNTER A RESET MODES

(1) MANUAL RESET TO ZERO MAINTAINED RESET (-1) MANUAL RESET TO ZERO MOMENTARY RESET

64 ( )

COUNTER A SCALE MULTIPLIER

(1) x1 (2) x0.1 (3) x0.01 (4) x0.001

65 ( )

COUNTER A DECIMAL POINT & LEADING ZERO BLANKING

(1)	0	(-1)	0 0 0 0 0 0 (NO L.Z.B.)
(2)	0.0	(-2)	0 0 0 0 0.0
(3)	0.0 0	(-3)	0 0 0 0.0 0
(4)	0.0 0 0	(-4)	0 0 0.0 0 0
(5)	0.0 0 0 0	(-5)	0 0.0 0 0 0
(6)	0.0 0 0 0 0	(-6)	0.0 0 0 0 0

"OPERATOR ACCESSIBLE FUNCTIONS" MODES

(With "PGM. DIS." terminal to "COMM")

66 ( )

MODE	PRESET VALUE	SCALE FACTORS	COUNTER LOAD VALUE	RESET BUTTON &TERMINAL
(1)				●
(-1)				
(2)	●			●
(-2)	●			
(3)		●		●
(-3)		●		
(4)	●	●		●
(-4)	●	●		
(5)	●		●	●
(-5)	●		●	
(6)	●	●	●	●
(-6)	●	●	●	

☆ Entering a [41 -2], at any time will load factory settings for all modes.

GEMINI 4100 PROGRAMMING

SOME NOTES & HINTS ON PROGRAMMING THE GEMINI 4100

1. Be systematic about programming! Plan out the exact features & functions you need for your application. Write out the code entries you need from start to finish, and then enter the codes completely. Don't start in the middle of the program codes & make arbitrary entries to "see what it will do." This is a sure way to create confusing results. Finally, after you are done, record your program & file it where you can find it later if you want to make changes. You can use this card to write in your codes in the program ladder on the reverse side, together with any fixed data entries, for convenient future reference.

2. Watch out for conflicting modes! The programs in the GEMINI 4100 have been written to prevent illegal code entry. However, to provide optimum flexibility, some reliance must be placed on the programmer to avoid conflicting codes.

3. The GEMINI 4100 can be interrogated at any time to see what modes & data entries have been made. Such interrogation can be made during a counting cycle or a sample time run without interrupting the normal counting process. In the lockout mode, all functions can also be interrogated, but those functions locked out cannot be changed. Making changes in program modes or data during a run is not recommended since mid-cycle changes can result in unanticipated outputs for that particular cycle.

PROGRAMMING PROCEDURE FOR FUNCTION & MODE SELECTION ☆

(Applies To Programming Chart)

To enter a programmable function or mode, enter the function selector code desired and then select the particular mode identifier required.

For example, to set up a decimal point to display a reading in 1/100ths with leading zero blanking, function selector code #46 must be entered. (See codes on reverse side.)

Press button #4, then button #6. The display will temporarily interrupt its normal readout (without interfering with the normal operation of the unit). It will then display the entered code on the L.H. side.

[46] (DISPLAY READOUT)

Next, enter the mode identifier (button #3) that defines the decimal point location & LZB condition. This code is displayed on the right.

[46 3] (DISPLAY READOUT)

Now, enter this new selection by pressing the "E" button.

PROGRAMMING PROCEDURE FOR DATA ENTRY

In data entry, the front panel pushbuttons are identified by two different sets of references and will cause two different reactions in the course of making a data entry.

In the first phase of a data entry cycle, the particular data entry mode is called up by pushing the buttons identified by their panel markings. (i.e. Buttons "5", "3", or "1"). Once the data entry mode has been entered, the existing data appears on the display and the buttons below the display reference themselves to the digits directly above each button. The data can then be changed a digit at a time by depressing the button directly below the digits to be changed.

After the new data value is obtained, the "E" button is depressed to enter the new value.

[53] TIMED OUTPUT VALUE ☆

Entering Code "53" will call up the Timed Output Value in seconds & hundredths. The value can be set to the new value by incrementing each digit with the button underneath that digit.

Press the "E" button to enter the new Timed Output value. (Max. Timed Output value = 599.99 sec.)

[3] SCALE FACTOR

One stroke of the "3" button calls up the existing Scale Factor for the currently displayed count or rate value. (The Scale Factor is the multiplier used to convert the actual count or rate to the direct readout display). The value can be changed by incrementing each digit with the button below it. Pressing the "E" key enters the new S.F. The S.F. can be set at any value from +/- 0.0001 to +/-5.9999. (Positive only for Rate Scale Factor A.)

[1] PRESET

One stroke of the "1" button calls up the preset value, which can then be changed by incrementing each digit with the button below it. Press the "E" button to enter the new Preset.

☆ Program before connecting "PGM. DIS." to "COMMON".

SELF TEST ROUTINE 6, +/-

Depressing "6" & then "+/-" starts the self test routine by lighting all decimal points, then all 9's, all 8's, all 7's etc., until alternate 8's & 9's are displayed. At this time, the output can be manually activated for testing by pressing the "1" button. (The Output test is disabled when "PGM. DIS." terminal is pulled to "COMMON".) An automatic exit will occur six (6) seconds after the Test Mode is completed. Test Mode can be run at any time and will not interfere with the normal operation of the Gemini 4100.

APPENDIX "H" - GEMINI 4200 COUNTER/RATE PROGRAMMING CHART

FEATURE & MODE SELECTION (See Programming Procedure)

41 (1) ☆

DETAILED MODE MENUS

42 ( )

RESET BUTTON & TERMINAL ACTUATION MODES

(1) RST RATE OUTPUT (2) RST COUNTER (3) RST RATE OUTPUT & COUNTER

43 ( )

INPUTS 1 & 2 RESPONSE MODES

(1) 1 = CNT. & RATE, 2 = INH. (CNT.)
(2) 1 = CNT. & RATE, 2 = UP/DN
(3) 1 = CNT. UP & RATE, 2 = CNT. DN.
(4) 1 = RATE, 2 = CNT.
(5) QUADRATURE X1 (1 = RATE)
(6) QUADRATURE X4 (1 = RATE)

44 ( )

INPUT PULSE EDGES REGISTERING COUNTS (Counter B)*

(1) NEG. GOING EDGES ONLY (1 count/pulse)
(2) BOTH + & - EDGES (2 counts/pulse)

* Not accessible with Quadrature X4 Input Response Mode.

45 ( )

COUNTER SCALE MULTIPLIER

(1) x1 (2) x0.1 (3) x0.01 (4) x0.001

46 ( )

COUNTER DECIMAL POINT & LEADING ZERO BLANKING

(1)	0	(-1)	0 0 0 0 0 0 (NO L.Z.B.)
(2)	0.0	(-2)	0 0 0 0 0.0
(3)	0.0 0	(-3)	0 0 0 0.0 0
(4)	0.0 0 0	(-4)	0 0 0.0 0 0
(5)	0.0 0 0 0	(-5)	0 0.0 0 0 0
(6)	0.0 0 0 0 0	(-6)	0.0 0 0 0 0

51 ( )

OUTPUT ASSIGNMENT *

(±1) OUT 1→RATE, OUT 2→CNTR (±2) OUT 1 & 2→CNTR (±3) OUT 1 & 2→RATE

* A (-) preceding the mode identifier enables Preset 1 to track Preset 2.

OUTPUT 1 TERMINATION MODES

52 ( )

MODE	AT OUTPUT 2 START	AT OUTPUT 2 END	AT RESET START	AT RESET END	AFTER TIMED OUTPUT 1	BOUNDARY MODE	OUTPUT 1 NORMALLY "OFF"	OUTPUT 1 NORMALLY "ON"
† (1)	●						●	
† (-1)	●							●
† (2)		●					●	
† (-2)		●						●
(3)			●				●	
(-3)			●					●
(4)				●			●	
(-4)				●				●
‡ (5)					●		●	
‡ (-5)					●			●
* (6)						●	●	
* (-6)						●		●

† These modes are available only when [51 2] is programmed.
‡ Output 1 activates when Count or Rate ≥ Preset 1 [51 1,2].
Output 1 activates when Rate ≤ Preset 1 [51 3].
* BOUNDARY MODE: Output goes "OFF" when Count or Rate < Preset and goes "ON" when Count or Rate is ≥ Preset as the value goes up and down through the Preset.

53 ( )

TIMED OUTPUT 1 VALUE

Timed Output Value range; 0.01 to 599.99 Sec

OUTPUT 2 TERMINATION MODES

54 ( )

MODE	AT OUTPUT 1 START	AT OUTPUT 1 END	AT RESET START	AT RESET END	AFTER TIMED OUTPUT 2	BOUNDARY MODE	OUTPUT 2 NORMALLY "OFF"	OUTPUT 2 NORMALLY "ON"
† (1)	●						●	
† (-1)	●							●
† (2)		●					●	
† (-2)		●						●
(3)			●				●	
(-3)			●					●
(4)				●			●	
(-4)				●				●
‡ (5)					●		●	
‡ (-5)					●			●
* (6)						●	●	
* (-6)						●		●

† These modes are available only when [51 2] is programmed.
‡ Output 2 activates when Count or Rate ≥ Preset 2.
* BOUNDARY MODE: Output goes "OFF" when Count or Rate < Preset and goes "ON" when Count or Rate is ≥ Preset as the value goes up and down through the Preset. Automatically selects [56 1] if [51 1 or 2] is programmed.

55 ( )

TIMED OUTPUT 2 VALUE

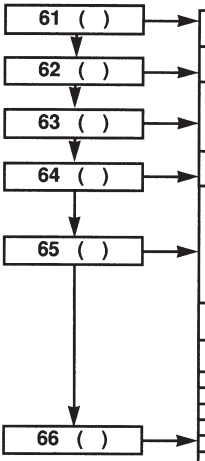
Timed Output Value range; 0.01 to 599.99 Sec

COUNTER RESET MODES

56 ( )

MODE	RESET TO ZERO	RESET TO PRESET 2	AUTO RST AFTER TIMED OUT. 2	AUTO RST AT TIMED OUT. 2	MAINTAINED MANUAL RST	MOMENTARY MANUAL RST
* (1)	●				●	
* (-1)	●					●
(2)		●			●	
(-2)		●				●
(3)	●		●		●	
(-3)	●		●			●
(4)		●	●		●	
(-4)		●	●			●
(5)	●			●	●	
(-5)	●			●		●
(6)		●		●	●	
(-6)		●		●		●

*Automatically selected when [54 6] or [51 3] is programmed.



RATE RIGHT HAND DUMMY ZEROS

(1) 0 (2) 00 (3) 000 (4) NONE

RATE CONVERSION FACTOR

(1) RATE/SEC (x1) (2) RATE/MINUTE (x60) (3) RATE/HR. (x3600)

RATE MINIMUM UPDATE TIME*

(1) 0.5 Sec (2) 1 Sec (3) 2 Sec
(4) 4 Sec (5) 8 Sec (6) 16 Sec

* Maximum update time varies with each minimum update time.

RATE SCALE MULTIPLIER

(1) x1000 (2) x100 (3) x10 (4) x1 (5) x0.1 (6) x0.01

RATE DECIMAL POINT & LEADING ZERO BLANKING

(1)	0	(-1)	0 0 0 0 0 0 (NO L.Z.B.)
(2)	0.0	(-2)	0 0 0 0 0.0
(3)	0.0 0	(-3)	0 0 0 0.0 0
(4)	0.0 0 0	(-4)	0 0 0.0 0 0
(5)	0.0 0 0 0	(-5)	0 0.0 0 0 0
(6)	0.0 0 0 0 0	(-6)	0.0 0 0 0 0

"OPERATOR ACCESSIBLE FUNCTIONS" MODES

(With "PGM. DIS." terminal to "COMM")

MODE	PRESET VALUE	SCALE FACTORS	COUNTER LOAD VALUE	RESET BUTTON &TERMINAL
(1)				●
(-1)				
(2)	●			●
(-2)	●			
(3)		●		●
(-3)		●		
(4)	●	●		●
(-4)	●	●		
(5)	●		●	●
(-5)	●		●	
(6)	●	●	●	●
(-6)	●	●	●	

☆ Entering a [41 -1], at any time will load factory settings for all modes.

APPENDIX "H" - GEMINI 4200 DUAL COUNTER PROGRAMMING CHART

FEATURE & MODE SELECTION (See Programming Procedure)

41 (2) ☆

42 ( )

43 ( )

44 ( )

45 ( )

46 ( )

51 ( )

52 ( )

53 ( )

54 ( )

55 ( )

56 ( )

DETAILED MODE MENUS

RESET BUTTON & TERMINAL ACTUATION MODES

(1) RST COUNTER A (2) RST COUNTER B (3) RST COUNTER A & B

INPUTS 1 & 2 RESPONSE MODES

(1) 1 = CNT. (A & B), 2 = INH. (2) 1 = CNT. (A & B), 2 = UP/DN
(3) 1 = CNT. UP (A & B), 2 = CNT. DN.(A & B) (4) 1 = CNT. A, 2 = CNT. B
(5) QUADRATURE X1 (A & B) (6) QUADRATURE X4 (A & B)

INPUT PULSE EDGES REGISTERING COUNTS (Counter A & B)*

(1) NEG. GOING EDGES ONLY (1 count/pulse) (2) BOTH + & - EDGES (2 counts/pulse)

* Not accessible with Quadrature X4 Input Response Mode.

COUNTER B SCALE MULTIPLIER

(1) x1 (2) x0.1 (3) x0.01 (4) x0.001

COUNTER B DECIMAL POINT & LEADING ZERO BLANKING

(1)	0	(-1) 0 0 0 0 0 0 (NO L.Z.B.)
(2)	0.0	(-2) 0 0 0 0 0.0
(3)	0.0 0	(-3) 0 0 0 0.0 0
(4)	0.0 0 0	(-4) 0 0 0.0 0 0
(5)	0.0 0 0 0	(-5) 0 0.0 0 0 0
(6)	0.0 0 0 0 0	(-6) 0.0 0 0 0 0

OUTPUT ASSIGNMENT *

(±1) OUT. 1→CNTR A, OUT. 2→CNTR B (±2) OUT. 1 & 2→CNTR B

* A (-) preceding the mode identifier enables Preset 1 to track Preset 2.

OUTPUT 1 TERMINATION MODES

MODE	AT OUTPUT 2 START	AT OUTPUT 2 END	AT RESET START	AT RESET END	AFTER TIMED OUTPUT 1	BOUNDARY MODE	OUTPUT 1 NORMALLY "OFF"	OUTPUT 1 NORMALLY "ON"
† (1)	●						●	
† (-1)	●							●
† (2)		●					●	
† (-2)		●						●
(3)			●				●	
(-3)			●					●
(4)				●			●	
(-4)				●				●
(5)					●		●	
(-5)					●			●
* (6)						●	●	
* (-6)						●		●

† These modes are available only when [51 2] is programmed.
* BOUNDARY MODE: Output goes "OFF" when Count < Preset and goes "ON" when Count is ≥ Preset as the value goes up and down through the Preset. Automatically selects [61 1], if [51 1] is programmed.

TIMED OUTPUT 1 VALUE

Timed Output Value range; 0.01 to 599.99 Sec

OUTPUT 2 TERMINATION MODES

MODE	AT OUTPUT 1 START	AT OUTPUT 1 END	AT RESET START	AT RESET END	AFTER TIMED OUTPUT 2	BOUNDARY MODE	OUTPUT 2 NORMALLY "OFF"	OUTPUT 2 NORMALLY "ON"
† (1)	●						●	
† (-1)	●							●
† (2)		●					●	
† (-2)		●						●
(3)			●				●	
(-3)			●					●
(4)				●			●	
(-4)				●				●
(5)					●		●	
(-5)					●			●
* (6)						●	●	
* (-6)						●		●

† These modes are available only when [51 2] is programmed.
* BOUNDARY MODE: Output goes "OFF" when Count < Preset and goes "ON" when Count is ≥ Preset as the value goes up and down through the Preset. Automatically selects [56 1].

TIMED OUTPUT 2 VALUE

Timed Output Value range; 0.01 to 599.99 Sec

COUNTER B RESET MODES

MODE	RESET TO ZERO	RESET TO PRESET 2	AUTO RST AFTER TIMED OUT. 2	AUTO RST AT TIMED OUT. 2	MAINTAINED MANUAL RST	MOMENTARY MANUAL RST
* (1)	●				●	
* (-1)	●					●
(2)		●			●	
(-2)		●				●
(3)	●		●		●	
(-3)	●		●			●
(4)		●	●		●	
(-4)		●	●			●
(5)	●			●	●	
(-5)	●			●		●
(6)		●		●	●	
(-6)		●		●		●

*Automatically selected when [54 6] is programmed.

61 ( )

64 ( )

65 ( )

66 ( )

COUNTER A RESET MODES

MODE	RESET TO ZERO	RESET TO PRESET 1	AUTO RST AFTER TIMED OUT. 1	AUTO RST AT TIMED OUT. 1	MAINTAINED MANUAL RST	MOMENTARY MANUAL RST
* (1)	●				●	
* (-1)	●					●
(2)		●			●	
(-2)		●				●
(3)	●		●		●	
(-3)	●		●			●
(4)		●	●		●	
(-4)		●	●			●
(5)	●			●	●	
(-5)	●			●		●
(6)		●		●	●	
(-6)		●		●		●

*Automatically selected when [51 2] or [52 6] is programmed.

COUNTER A SCALE MULTIPLIER

(1) x1 (2) x0.1 (3) x0.01 (4) x0.001

COUNTER A DECIMAL POINT & LEADING ZERO BLANKING

(1)	0	(-1) 0 0 0 0 0 0	(NO L.Z.B.)
(2)	0.0	(-2) 0 0 0 0 0.0	
(3)	0.0 0	(-3) 0 0 0 0.0 0	
(4)	0.0 0 0	(-4) 0 0 0.0 0 0	
(5)	0.0 0 0 0	(-5) 0 0.0 0 0 0	
(6)	0.0 0 0 0 0	(-6) 0.0 0 0 0 0	

"OPERATOR ACCESSIBLE FUNCTIONS" MODES

(With "PGM. DIS." terminal to "COMM")

MODE	PRESET VALUE	SCALE FACTORS	COUNTER LOAD VALUE	RESET BUTTON &TERMINAL
(1)				●
(-1)				
(2)	●			●
(-2)	●			
(3)		●		●
(-3)		●		
(4)	●	●		●
(-4)	●	●		
(5)	●		●	●
(-5)	●		●	
(6)	●	●	●	●
(-6)	●	●	●	

☆ Entering a [41 -1], at any time will load factory settings for all modes.

GEMINI 4200 PROGRAMMING

SOME NOTES & HINTS ON PROGRAMMING THE GEMINI 4200

1. Be systematic about programming! Plan out the exact features & functions you need for your application. Write out the code entries you need from start to finish, and then enter the codes completely. Don't start in the middle of the program codes & make arbitrary entries to "see what it will do." This is a sure way to create confusing results. Finally, after you are done, record your program & file it where you can find it later if you want to make changes. You can use this card to write in your codes in the program ladder on the reverse side, together with any fixed data entries, for convenient future reference.

2. Watch out for conflicting modes! The programs in the GEMINI 4200 have been written to prevent illegal code entry. However, to provide optimum flexibility, some reliance must be placed on the programmer to avoid conflicting codes.

3. The GEMINI 4200 can be interrogated at any time to see what modes & data entries have been made. Such interrogation can be made during a counting cycle without interrupting the normal counting process. In the lockout mode, all functions can also be interrogated, but those functions locked out cannot be changed. Making changes in program modes or data during a run is not recommended since mid-cycle changes can result in unanticipated outputs for that particular cycle.

PROGRAMMING PROCEDURE FOR FUNCTION & MODE SELECTION ☆

(Applies To Programming Chart)

To enter a programmable function or mode, enter the function selector code desired and then select the particular mode identifier required.

For example, to set up a decimal point to display a reading in 1/100ths with leading zero blanking, function selector code #46 must be entered. (See codes on reverse side.)

Press button #4, then button #6. The display will temporarily interrupt its normal readout (without interfering with the normal operation of the unit). It will then display the entered code on the L.H. side.

[46] (DISPLAY READOUT)

Next, enter the mode identifier (button #3) that defines the decimal point location & LZB condition. This code is displayed on the right.

[46 3] (DISPLAY READOUT)

Now, enter this new selection by pressing the "E" button.

PROGRAMMING PROCEDURE FOR DATA ENTRY

In data entry, the front panel pushbuttons are identified by two different sets of references and will cause two different reactions in the course of making a data entry.

In the first phase of a data entry cycle, the particular data entry mode is called up by pushing the buttons identified by their panel markings. (i.e. Buttons "5", "3", or "1"). Once the data entry mode has been entered, the existing data appears on the display and the buttons below the display reference themselves to the digits directly above each button. The data can then be changed a digit at a time by depressing the button directly below the digits to be changed.

After the new data value is obtained, the "E" button is depressed to enter the new value.

[53,55] TIMED OUTPUT VALUES ☆

Entering Code "53"or "55" will call up the Timed Output 1 or 2 Value in seconds & hundredths. The value can be set to the new value by incrementing each digit with the button underneath that digit. Press the "E" button to enter the new Timed Output value. (Max. Timed Output value = 599.99 sec.)

[3] SCALE FACTORS

One stroke of the "3" button calls up the existing Scale Factor for the currently displayed count or rate value. (The Scale Factor is the multiplier used to convert the actual count or rate to the direct readout display). The value can be changed by incrementing each digit with the button below it. Pressing the "E" key enters the new S.F. The S.F. can be set at any value from +/- 0.0001 to +/-5.9999. (Positive only for Rate Scale Factor A.)

[1,2] PRESETS

One stroke of the "1" or "2" button calls up the preset 1 or 2 value, which can then be changed by incrementing each digit with the button below it. Press the "E" button to enter the new Preset.

☆ Program before connecting "PGM. DIS." to "COMMON".

SELF TEST ROUTINE 6, +/-

Depressing "6" & then "+/-" starts the self test routine by lighting all decimal points, then all 9's, all 8's, all 7's etc., until alternate 8's & 9's are displayed. At this time, the output can be manually activated for testing by pressing the "1" or "2" button. (The Output test is disable when "PGM. DIS." terminal is pulled to "COMMON".) An automatic exit will occur six (6) seconds after the Test Mode is completed. Test Mode can be run at any time and will not interfere with the normal operation of the Gemini 4200.

APPENDIX "I" - ORDERING INFORMATION

MODEL NO.	DESCRIPTION	W/20 mA Current Loop	PART NUMBERS 115/230 VAC
GEM41	Gemini 4100	No	GEM41060
		Yes	GEM41160
GEM42	Gemini 4200	No	GEM42060
		Yes	GEM42160
—	Gemini 4100 Relay Board		RLYBD001
—	Gemini 4200 Relay Board		RLYBD002
For Information on Pricing, Enclosures & Panel Mount Kits, refer to the RLC Catalog or contact your local RLC distributor.			

LIMITED WARRANTY

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company's liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company's option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company's products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained and relies on no other warranties or affirmations.

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