MODEL 5881-1400
8 DIGIT TOTALIZING ELECTRONIC COUNTER
WITH 5 DIGIT SCALE FACTOR
Also Models 58815-400 & 58815-403

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WARNING: This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

Printed in U.S.A.
The Durant Model 5881-1400 is a versatile, eight-digit, bi-directional totalizer. The counter functions as a totalizer, accumulating counts until manually reset with provision for entering an offset value to allow resetting to a non-zero number.

The 5881-1400 Model also features the ability to scale incoming counts. This means that for each pulse received on the count inputs, a fraction or multiple of that pulse is indicated on the display. Scaling is useful to make conversions between different units of measure (inches to centimeters, for example) or to totalize parts produced from multiple part manufacturing processes (such as six parts produced for each operation of a press).

The scale factor can be a number from 0.0001 to 9.9999. This number becomes a factor by which incoming count pulses are multiplied. The result of the multiplication is shown on the front panel display.

A non-volatile memory insures that the setup instructions will not be lost if power is interrupted. The Count Value and the Scale Factor are also retained if a power loss interrupts a process or machine cycle.

The front panel of the counter, Figure 1, is framed by a bezel that seals the panel to the mounting surface. A large, eight-digit high visibility red LED display with a programmable decimal point position is located in the upper left portion of the panel. The keyboard has a polycarbonate Lexan front face and consists of ten data keys (0 through 9), "COUNT" key, "RESET" key, "FUNCTION" key and "ENTER" key. The "1" data key also serves as the "OFFSET" key. The upper right portion of the front panel contains two yellow LED indicators for Count and Offset operation.

The rear panel, Figure 2, contains screw terminals for use with stripped wire, either solid or stranded, from 28 to 14 gauge.

The counter provides two-way serial communication with remote devices using standard ASCII code and three selectable Baud rates. Count, Offset and Scale Factor data can be sent and Offset and Scale Factor data and Print Request commands can be received by the control via two 20-milliampere current loops. Optional accessories are available to convert the communication loop to RS-232, parallel BCD and multiplexed BCD formats.

Model 58815-400 includes a 1/Tau ratemeter function. The word "Rate" is added above the "4" button. Pressing this button toggles the display between count and rate. All count and control functions continue while viewing the rate value. All other features are the same as the 58811-400 model. See page 46 for a full description of the rate feature.

Model 58815-403 adds analog input capability to Model 58815-400.

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**Figure 1. 5881-1400 8-Digit Electronic Totalizer with Scaling**
The count input circuit provides the user with several options:

1. Separate add and subtract inputs.
2. Count input with up/down control input.
3. Quadrature input.
4. Count doubling in any of the three above configurations.

5. Count up input with count inhibit input.
6. High or low speed operation. Low speed operation provides maximum immunity to contact bounce and noise.

The control is equipped with self-diagnostics which test the internal memories for faults. Should a fault be detected, an indication is given on the display. Displays and indicators are turned on in a patterned sequence for visual examination.
SPECIFICATIONS

POWER REQUIREMENTS:
AC Operation:
115/230 VAC (+10%, -20%) 47-63 Hz

DC Operation:
11-28 VDC

Power:
18 watts

DC POWER OUTPUT:
15 VDC (+1, -2).
150 mA if powered from AC or less than 24 VDC
100 mA if powered from 24 VDC or greater

NOTE: DC power output is only regulated if unit is powered by AC or greater than 18.5 VDC.

ENVIRONMENT:
Operating Temperature:
32 to 130° F (0 to 55° C)

Storage Temperature:
-40 to 160° F (-40 to 70° C)

Operating Humidity:
85% non-condensing relative

PHYSICAL:
Case Dimensions:
5.38" W x 2.62" H x 5.53" D
(136.7 mm W x 66.5 mm H x 140.5 mm D)

Bezel Dimensions:
5.80" W x 3.04" H x 0.17" D
(147.3 mm W x 77.2 mm H x 4.3 mmD)

LIP:
0.2 (5.0 mm)

Panel Cut-out Dimensions:
5.43" W x 2.68" H
(138mm W x 68mm H, DIN)

Mounting Panel Thickness:
0.50" (12.7mm) maximum
(without optional spacer provided)
0.077" (1.96mm) maximum
(with optional spacer provided)

Front panel will provide watertight seal with gasket provided.

Case Material:
Cadon FRX plastic case with Lexan front face overlay

Weight:
2.2 lbs. (1.0 Kg)

Display Size:
8 digits, 0.56" (14.2mm) H
(with programmable decimal point location)

Memory Types:
PROM, RAM, Non-volatile NVRAM

COUNTER:
Count Range:
8 digits (0 to 99,999,999) with rollover

Preset Range:
8 digits (0 to 99,999,999) (Offset is used to reset to a non-zero number.)

Count Modes:
Count with Add and Subtract inputs
Count with Up/Down direction input
(Hardware doubling for above modes is provided.)
Count with Count Inhibit input
Quadrature
Doubled Quadrature

Count Speed (Scale Factor of 1.0000 assumed)
0 to 7,500 counts per second (CPS) with Durant Shaft Encoders or solid state sensors.
0 to 3,750 CPS when hardware doubling is implemented or when quadrature shaft encoders are used.
0 to 150 CPS when Low Frequency is selected.

COUNT INPUT RATINGS:
The count inputs are designed to work with current sinking sensors (open-collector NPN transistor output with or without passive pull-up resistor) or contact closures to DC Common.

Input Voltage:
High state (Logical “1”, sensor off or contact open):
10.5 to 24.5 VDC when control is powered by AC line
SPECIFICATIONS

7.0 to 24.5 VDC when control is powered by 11 VDC
11.0 to 24.5 VDC when control is powered by 16 VDC

Low state (Logical “0”, sensor on or contact closed):
0 to 4.5 VDC when control is powered by AC line
0 to 3.3 VDC when control is powered by 11 VDC.
0 to 4.8 VDC when control is powered by 16 VDC.

Input Impedance:
6800 ohms to 15 VDC when control is powered by AC line
6800 ohms to 10 VDC when control is powered by DC supply

Input Current:
20 mA peak, 3 mA steady state

Input Response:
High State (Logical “1”, sensor off or contact open)
High Speed (Low Speed jumpers not connected):
110µsec minimum at 15 VDC (6,800 ohms to +DC)
160µsec minimum at 13.5 VDC (50,000 ohms to +DC)

High State (Logical “1”, sensor off or contact open)
Low Speed (Low Speed jumpers connected):
5.5 msec minimum at 15 VDC (6,800 ohms to +DC)
7.5 msec minimum at 13.5 VDC (50,000 ohms to +DC)

Low State (Logical “0”, sensor on or contact closed)
High Speed (Low Speed jumpers not connected):
20 µsec minimum at 0.1 VDC (0 ohms to DC Common)
45 µsec minimum at 1.5 VDC (500 ohms to DC Common)

Low State (Logical “0”, sensor on or contact closed)
Low Speed (Low Speed jumpers connected):
1.0 msec minimum at 0.1 VDC (0 ohms to DC Common)
2.0 msec minimum at 1.5 VDC (500 ohms to DC Common)

SCALE FACTOR:
Range: 5 digits (0.0001 to 9.9999)

CONTROL INPUTS:

Input Voltage:
High State (Logical “1”, contact open):
15 VDC maximum
Low State (Logical “0”, contact closed):
1.2 VDC maximum

Input Impedance:
4.75K ohms to +5 VDC.

Threshold:
High +3.5 to +22 VDC.
Low +0.0 to 1.0 VDC.

Response Time:
Min. High 5.3 ms.
Min. Low 3.9 ms.

Note: The reset and unlatch signals will both occur in less than 200 microseconds after the input signal is detected. The start of the print will occur within 2 milliseconds after the input is detected if the unit is not counting.

OUTPUT RATINGS:

Transistor Outputs:
Type: Open collector NPN transistor with Zener diode transient surge protection
Load Voltage: 30 VDC maximum
Load Current: 300 milliamps maximum per transistor. 480 milliamps total for all transistors.

Rev. 50-59: Use 90 milliamps per relay coil when calculating total transistor current.

Rev. 60 - up: Use 5 milliamps per relay coil when calculating total transistor current.
SPECIFICATIONS

DIAGNOSTIC MODES:
ROM Checksum
RAM Bit Test
NVRAM Read/Write Test
NVRAM Store Test
NVRAM Checksum
Watchdog Timer
Display and LED Indicator Test

Data Type:
Standard ASCII code

Format:
Start bit, 7 ASCII data bits, Parity bit, one or
two Stop bits (Even parity for Serial Data
Output, no parity for Serial Data Input)

Information Transmitted:
Count value
Offset value
Scale Factor

Information Received:
Print request
Offset value
Scale Factor

COMMUNICATIONS:
Interface Type:
Dual port 20 milliamp current loop

Speed:
110, 300 and 1200 Baud, user selectable
DESCRIPTION OF OPERATING MODES

COUNT MODES
The control has five count modes, which are: Count with separate add and subtract inputs, Count with direction control input, Count up with inhibit control input, Quadrature, and Doubled Quadrature.

Add and Subtract Inputs
The add and subtract mode allows separate signals to simultaneously add and subtract counts. It can be used to indicate material stretch, subtract defective parts from total parts produced, etc.

Count With Directional Control
Count with direction control modes uses one input for incoming count pulses and the other to inform the control whether the pulses should be used to add or subtract counts. Count with direction may be used when an item must be measured or positioned. Many types of sensors or control systems utilize count signals of this nature.

In both of the above count modes, the counter will normally increment or decrement on the falling edge of the incoming count pulse. (The falling edge is defined as the moment in time when the pulse changes state from +DC to DC Common potential.) Doubling allows the counter to increment or decrement on both the falling and the rising edges of the pulse. (The rising edge is defined as the moment when the pulse changes state from DC Common to +DC potential.)

Count With Inhibit Control
The count up with inhibit control mode provides an input which increments the control and an input which causes incoming count pulses to be ignored. This mode can be used when defective material must be ignored or when inspection samples are taken without incrementing the counter. The count up with inhibit control mode may not be doubled.

Quadrature Inputs
Quadrature counting makes use of two count signals which are phase shifted by 90 degrees. The detection of which signal is rising first allows the counter to know in what direction the shaft is turning.

When Quadrature count sources are being used, the Double Input must always be connected to DC Common to allow the quadrature signals to be decoded.

Quadrature Input Doubled
Doubled Quadrature is implemented by programming. This mode allows the counter to count on both the rising and falling edges of the incoming count pulses. The number of pulses per revolution of the shaft encoder is effectively doubled, increasing the resolution without any loss of accuracy.

COUNT SCALING
When the 5881-1400 receives a count pulse in any count mode, the 1 pulse is multiplied by the Scale Factor. The 5881-1400 adds the scaled value to the result for count-up pulses and subtracts the scaled value from the result for count-down pulses. The display shows the accumulated total in whole increments.

DECIMAL POINT LOCATION
The location of the decimal point on the display is programmed and may be located between any two digits on the display, or omitted. When a printer is connected to the serial communication output, the decimal point is printed.

The decimal point remains on the display whenever the actual value of the counter or the offset value is being displayed. It is not lit when function codes or other function entries are being displayed. The scale factor automatically displays the decimal point to indicate four decimal places.

COUNTER OPERATING MODES
When the “RESET” key is pressed, or the Reset input is energized, the counter is reset to zero or to a previously programmed offset value. The offset value is used when the counter should start at a value other than zero. This pre-programmed offset allows for distances between sensors and drive rollers, actuators, or manipulators.

RATE MODE (Model 58815-40X only)
See page 47.
GENERAL

When mounting, the location selected must provide for adequate air circulation space around the unit. Avoid locating the unit near instruments and/or equipment that generate excessive heat. Figure 3 shows recommended cutout and product dimensions as well as mounting details.

GENERAL WIRING PRACTICES

1. Disconnect all power before wiring terminals. A safety hazard exists if this precaution is not observed. Treat all control and count inputs as hazardous since they may carry line voltage.

Figure 3. Panel Mounting Dimensions
2. Use shielded cables for count signals, control input and communications signals. Connect shield to common (terminal 2, 3, or 4) of counter to terminate properly.

3. Keep all signal lines as short as possible.

4. Do NOT bundle or route signal lines with power or machine control wiring. Use separate conduit for power and signal wires.

5. Provide “clean” power to the counter. In severe cases, power may have to be filtered or a separate power source used. Do not use the same power source that is supplying the loads.

6. Use 18 ga. minimum (1mm², 600V) and 14 ga. maximum (2.1mm², 600V) wire for AC power wiring.

7. See Figure 6 for the correct fuse to be used in the power input wiring.

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**TERMINAL IDENTIFICATION**

**NOTE:** TERMINALS NOT LISTED ARE UNIDENTIFIED AND MUST REMAIN UNCONNECTED

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 -</td>
<td></td>
</tr>
<tr>
<td>2 -</td>
<td></td>
</tr>
<tr>
<td>3 -</td>
<td></td>
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<tr>
<td>4 -</td>
<td></td>
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<tr>
<td>5 -</td>
<td></td>
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<tr>
<td>6 -</td>
<td></td>
</tr>
<tr>
<td>7 -</td>
<td></td>
</tr>
<tr>
<td>8 -</td>
<td>DC COMMON</td>
</tr>
<tr>
<td>9 -</td>
<td>DC COMMON</td>
</tr>
<tr>
<td>10</td>
<td>COUNT INPUT 2</td>
</tr>
<tr>
<td>11</td>
<td>LOW FREQUENCY SELECT 2</td>
</tr>
<tr>
<td>12</td>
<td>DC COMMON</td>
</tr>
<tr>
<td>13</td>
<td>LOW FREQUENCY SELECT 1</td>
</tr>
<tr>
<td>14</td>
<td>COUNT INPUT 1</td>
</tr>
<tr>
<td>15</td>
<td>PROGRAM INHIBIT</td>
</tr>
<tr>
<td>16</td>
<td>PRINT REQUEST/DISPLAY LATCH</td>
</tr>
<tr>
<td>17</td>
<td>RESET</td>
</tr>
<tr>
<td>18</td>
<td>DOUBLE INPUT</td>
</tr>
<tr>
<td>19</td>
<td>11-16V DC SUPPLY</td>
</tr>
<tr>
<td>20</td>
<td>15V DC POWER OUTPUT</td>
</tr>
<tr>
<td>21</td>
<td>DC COMMON</td>
</tr>
<tr>
<td>22</td>
<td>NO CONNECTION</td>
</tr>
<tr>
<td>23</td>
<td>NO CONNECTION</td>
</tr>
<tr>
<td>24</td>
<td>NO CONNECTION</td>
</tr>
<tr>
<td>25</td>
<td>AC POWER INPUT</td>
</tr>
<tr>
<td>26</td>
<td>AC POWER INPUT</td>
</tr>
<tr>
<td>27</td>
<td>AC POWER INPUT</td>
</tr>
<tr>
<td>28</td>
<td>AC POWER INPUT</td>
</tr>
<tr>
<td>29</td>
<td>NO CONNECTION</td>
</tr>
<tr>
<td>30</td>
<td>NO CONNECTION</td>
</tr>
<tr>
<td>31</td>
<td>NO CONNECTION</td>
</tr>
<tr>
<td>32</td>
<td>CHASSIS GROUND</td>
</tr>
<tr>
<td>33</td>
<td>SERIAL DATA INPUT -</td>
</tr>
<tr>
<td>34</td>
<td>SERIAL DATA INPUT +</td>
</tr>
<tr>
<td>35</td>
<td>SERIAL DATA OUTPUT +</td>
</tr>
<tr>
<td>36</td>
<td>SERIAL DATA OUTPUT -</td>
</tr>
</tbody>
</table>

Figure 4. Terminal Designations
INSTALLATION INSTRUCTIONS

TERMINAL ASSIGNMENTS AND FUNCTION

#8, 12 AND 21 - DC COMMON

These terminals are internally connected to the negative side of the DC power supply.

#10 AND 14 - COUNT INPUTS

These two count inputs are used to increment or decrement the counter. Terminal #14 is labeled “COUNT INPUT 1” and terminal #10 is “COUNT INPUT 2.” The table shown in Figure 5 lists the operation of the two count inputs as related to the count function, and indicates how each input causes the counter to operate when a DC Common signal is applied.

#11 AND #13 - LOW FREQUENCY SELECT INPUTS

When contact closures are used for count sources, it must be remembered that the contacts will bounce slightly each time they close. This slight bounce can cause extra counts to be entered into the counter. Contact bounce can be eliminated by limiting the allowable frequency response at the count inputs. The low frequency select terminals reduce the count input frequency response from 7500 PPS to 150 PPS when they are connected to DC Common. Terminal #13 is LOW FREQUENCY SELECT for COUNT INPUT 1 (terminal #14) and terminal #11 is LOW FREQUENCY SELECT for COUNT INPUT 2 (terminal #10). Low frequency is selected by placing a jumper between terminal #11 and/or terminal #13 and DC Common. Use the Low Frequency inputs whenever possible to guard against electrical noise and interference.

#15 - PROGRAM INHIBIT INPUT

The PROGRAM INHIBIT terminal, when connected to DC Common through the use of a jumper, prevents all of the programming functions from being changed except the offset value.

#16 - PRINT REQUEST/DISPLAY LATCH INPUT

When the PRINT REQUEST terminal is connected to DC Common, the current count value, the current preset value or both are immediately transmitted through the SERIAL DATA OUTPUT terminals, #35 and #36. The data is transmitted once each time the Print Request input is energized. The input must be deenergized and reenergized for each transmission. The type of information transmitted is controlled by the Send Data function.

This terminal also serves to latch the value on the display while the control continues counting. When this terminal is energized, the count value being displayed is stored on the display and remains latched while the input is energized. The display returns to showing the value of the counter when the input is deenergized.

#17 - RESET INPUT

When terminal #17 is connected to DC Common through an external switch, relay, or sensor, the counter is remotely reset, which returns the counter value to zero. If an offset value has been entered, the counter value is changed to the offset value. The Reset input has the same function as the front panel "RESET" key.

<table>
<thead>
<tr>
<th>COUNT MODE</th>
<th>INPUT 1 (Term. #14)</th>
<th>INPUT 2 (Term. #10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Separate add and subtract</td>
<td>Subtract counts</td>
<td>Add counts</td>
</tr>
<tr>
<td>Count up with inhibit control</td>
<td>Add counts</td>
<td>Inhibit counts</td>
</tr>
<tr>
<td>Quadrature *</td>
<td>Input A</td>
<td>Input B</td>
</tr>
<tr>
<td>Count with up/down control</td>
<td>Count input</td>
<td>Up/Down control</td>
</tr>
<tr>
<td>Doubled quadrature *</td>
<td>Input A</td>
<td>Input B</td>
</tr>
</tbody>
</table>

*NOTE: For both Quadrature modes, the wires to inputs #1 and #2 may be interchanged to reverse count direction. Terminal #18 must also be tied to DC Common (terminal #8 or #12) for proper quadrature operation.

Figure 5. Count Input Operating Modes
INSTALLATION INSTRUCTIONS

#18 - DOUBLE INPUT

Connecting the Double Input to DC Common selects count doubling for either the Add and Subtract or the Count With Direction Control count modes. When either Quadrature or Doubled Quadrature count mode is selected, the Double Input must be connected to DC Common for proper operation.

#19 - BATTERY OR EXTERNAL 15 VDC SUPPLY

The power source can be either an external battery (11 to 16 volts) or a 15 VDC power supply. Connect this terminal to the positive side of the external low voltage supply and a DC Common terminal to the negative side.

#20 - 15 VDC POWER OUTPUT

This terminal may be used to power external devices such as sensors, a shaft encoder, or indicator lamps. The terminal supplies a regulated 15 VDC (+1V, -2V) to the loads at a maximum of 100 milliamps. The 15 VDC supply is generated only when the unit is powered by 115 or 230 VAC.

#25 THROUGH #28 - AC POWER INPUT

For 115 VAC operation, jumper terminal #25 to #28, and #26 to #27. Connect the AC line power to #25 and #26.

For 230 VAC operation, jumper #26 to #28. Connect the AC line power to #25 and #27.

#32 - CHASSIS GROUND

This terminal must be connected to earth ground to provide proper noise immunity. When shielded cable is used for sensors or communications wiring, connect the shields to this terminal.

When the unit is being used in a mobile, battery-powered application, this terminal MUST be connected to CHASSIS GROUND.

A factory installed green wire connects this terminal to DC Common. This is done to provide added immunity to static discharge and electrical interference. In control systems incorporating several electronic devices, it is accepted practice to provide one SYSTEM grounding point. In this case the green wire as provided may be removed and SEPARATE green wires attached to both Chassis Ground and DC Common for connection to the common system grounding point.

For applications which require isolated DC Common and chassis ground, the green jumper may be removed entirely. However, extra care must be taken to route current carrying wires away from the counter as much as possible. Shields in transducer cables should be connected to chassis ground wherever possible.

#33 AND #34 - SERIAL DATA INPUT

The serial communications input is used to receive new preset values and print requests. The interface utilized is a standard 20 milliamp current loop with a user selectable Baud rate.

Terminal #33 is the negative side of the current loop and #34 is the positive side. When connecting serial communications between the unit and any other device, note that SERIAL DATA OUT PLUS (SDO+) from the transmitting device is wired to the SERIAL DATA IN MINUS (SDI-) of the counter. Likewise, SDO- from the transmitting device is wired to SDI+ of the counter.

#35 AND #36 - SERIAL DATA OUTPUT

The counter has serial communications output which may be used to transmit the current count value, the preset value, or both. The Baud rate of the 20 milliamp current loop is user selectable. However, the Baud rate selected is the same for serial input and serial output communications.

Terminal #36 is the negative side of the output current loop and terminal #35 is the positive side. When connecting serial communications between the counter and any other device, note that SERIAL DATA OUT PLUS (SDO+) from the counter is wired to the SERIAL DATA IN MINUS (SDI-) of the device receiving the data. Likewise, SDO- from the counter is wired to SDI+ of the receiving device.

INTERCONNECTION

After determining the desired operating mode, select the appropriate figures 6 through 15 for connection diagrams for the application.
PANEL MOUNTING
The panel mounting kit includes: (1) mounting gasket, (2) mounting clips and (2) screws.

Refer to the dimension diagram in Figure 3 for a drawing of the correct installation of these parts.

The mounting gasket is coated on one side with a contact adhesive and a paper backing. Care should be taken during the gasket installation that the gasket be correctly positioned on the panel at the first attempt. Attempting to re-position the gasket once the adhesive has come in contact with the panel is likely to deform or tear the gasket. This may result in an improper seal. For best results, follow these directions:

1. Stand the counter on a desk or table with its display down, screw terminals up.
2. Remove and discard the center square of the gasket at the scribe marks in the gasket and paper backing. Do not remove the backing from the remaining outer rim.
3. Slide the gasket down the unit until it is in position at the rear of the unit’s front bezel. The paper backing side should be up.
4. Insert the tip of a knife between the paper and the gasket and, while holding the gasket down to the unit with the knife, peel off the paper backing.
5. Slide the unit through the panel cutout until the gasket firmly adheres to the panel.
6. Install the mounting clips and screws as shown in the diagram above. Do not overtighten the mounting screws. The screws should be tight enough to firmly hold the unit in place, but not so tight as to squeeze the gasket out from behind the front bezel.
7. A switch shall be included in the building installation:
   - It shall be in close proximity to the equipment and within easy reach of the operator.
   - It shall be marked as the disconnecting device for the equipment.
   - Switches and circuit breakers in Europe must comply with IEC 947.

Figure 6. 115 VAC 47/63 Hz Power Connection
Figure 7. 230 VAC 47/63 Hz Power Connection

Figure 8. 12 VDC Power Connection
Figure 9. Count Input Wiring

Figure 10. Quadrature Encoder Count Input Wiring
Figure 11. Encoder with Directional Control Count Input Wiring

Figure 12. Add and Subtract Count Input Wiring

NOTE: INSTALL LOW FREQUENCY JUMPER(S) WHEN COUNT SOURCE IS A CONTACT CLOSURE.
Figure 13. Remote Reset Wiring

Figure 14. Latch Until Contact Closure Wiring

NOTE:
JUMPER MAY BE INSTALLED FOR PERMANENT PROGRAM INHIBIT.
Figure 15. Serial Communications to Durant Communications Converter
DISPLAY
The eight-digit numeric display normally indicates the counter value. When functions are being programmed, the display indicates either the function code or the data being programmed. When power is applied to the counter, the display flashes at 1/2 second intervals for 4 seconds. The counter will accept count pulses during this period.

INDICATORS
Two yellow LED indicators in the form of “light bars” are located to the right of the display. These light bars indicate if the information displayed is the count value or offset value. Both are off when the scale factor or functions are being interrogated or modified.

KEYBOARD
Data Entry Keys (0 through 9)
The data entry keys are used to enter offset values, function codes and parameters.

“OFFSET” Key (1)
The “1” key also serves as the “OFFSET” key. The “OFFSET” key is used to select the offset value for interrogation or modification.

“RATE” Key
The “4” key also serves as a toggle between the count and rate values. All count and control functions continue while viewing the rate value.

“COUNT” Key
The use of this key after an interrogation or modification of an operating function will cause the count to display.

“FUNCTION’ Key
The “FUNCTION” key is used to change the programmable functions. When this key is pressed and followed by 2 digit code, the function to be interrogated or modified is selected. When the Program Inhibit terminal on the rear panel is connected to DC Common, the use of the “FUNCTION” key is limited to the interrogation of the programmable functions.

The “FUNCTION” key permits the programming of all functions except offset.

“RESET” Key
The “RESET” key, when pressed, resets the counter to the offset value. If an offset value has not been serially transmitted to the counter from an external device or entered via the keyboard the counter is reset to zero.

“ENTER” Key
When the “FUNCTION” key is pressed and a code is specified, the “ENTER” key is used to terminate and enter the code. The “ENTER” key is also used to terminate and enter a programmed value.

FUNCTION CODES
The control has many different programmable operating modes and selectable options. The user must select which of these functions will be used and how they should operate by specifying a Function Code on the keyboard and entering the correct value choice to select the desired mode. The functions may be reprogrammed at any time if the Program Inhibit terminal (terminal #15) is not connected to DC Common.

While the user is programming the various functions and their entry choices, the counter continues to operate normally, even though the display does not indicate the current value of the counter. This allows the operating parameters to be changed while the process being controlled is running. See Figure 16 for a complete table of the functions and their allowable entry choices.

⚠️ WARNING
CHANGING FUNCTION CODE VALUES WHILE THE PROCESS IS OPERATING MAY BE HAZARDOUS TO THE OPERATOR AND/OR THE MACHINERY. USE EXTREME CAUTION. IT IS RECOMMENDED THAT THE PROCESS BE STOPPED BEFORE FUNCTION CODE VALUES ARE MODIFIED WHENEVER POSSIBLE.

If an invalid Function Code is specified, the control ignores the selection and displays the current count value. An invalid Function Code is any code not listed in Figure 16.
If an invalid value is entered in a Function Code, the control ignores the entry and retains the previous setting. An invalid value is any value other than those allowable values listed in Figure 16.

When shipped from the factory, the control is programmed with the Function Codes set as indicated in Figure 16 with asterisks (*). When the user changes the values for any or all of the functions, the new values are stored in the non-volatile memory of the counter. This means that the new values are permanently stored until reprogrammed, even if power fails.

If it is desired to return the control to the factory set values after being reprogrammed, enter a value of “1” in function 43.

<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>FUNCTION CODE</th>
<th>ENTRY CHOICES</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>CURRENT COUNT VALUE</td>
<td>COUNT KEY</td>
<td>NONE</td>
<td>Shows current count value.</td>
</tr>
<tr>
<td>OFFSET</td>
<td>OFFSET KEY</td>
<td>*0 to 99,999,999</td>
<td>Defines Offset value. (Factory set value is zero.)</td>
</tr>
<tr>
<td>SCALE FACTOR</td>
<td>5</td>
<td>0.0001 to 9.9999 *1.0000</td>
<td>Defines scale factor value. (Factory set value is 1.0000)</td>
</tr>
<tr>
<td>COUNT OPERATION MODE</td>
<td>60</td>
<td>*0</td>
<td>Count with separate add (Input 2) and subtract (Input 1).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Count up (Input 1) with Inhibit control (Input 2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>NOTE: This mode cannot be doubled with double input.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Quadrature. NOTE: Double input MUST be connected to DC Common.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Count (Input 1) with up/down control (Input 2).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>Doubled Quadrature. NOTE: Double Input MUST be connected to DC Common.</td>
</tr>
<tr>
<td>DECIMAL POINT DISPLAY LOCATION</td>
<td>62</td>
<td>*0</td>
<td>No decimal points are displayed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>0000000.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>0000000.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>000000.000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>0000.0000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>000.00000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>00.000000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
<td>0.000000</td>
</tr>
<tr>
<td>RESET INPUT OPERATING MODE</td>
<td>82</td>
<td>*0</td>
<td>Maintained. Counter remains reset until the reset input is deenergized or</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>the &quot;RESET&quot; key is released.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Momentary. Instantaneously reset when input is energized or when &quot;RESET&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>key is pressed. Then allows counter to operate normally regardless of</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>whether reset input is held energized or &quot;RESET&quot; key is continuously</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>being pressed.</td>
</tr>
</tbody>
</table>

NOTE: Choices shown with asterisks are the factory set values.

Figure 16. Function Code Programming Table
## OPERATION

<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>FUNCTION CODE</th>
<th>ENTRY CHOICES</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMMUNICATIONS SPEED</td>
<td>90</td>
<td>0</td>
<td>110 Baud (Send and receive data at 110 bits per second.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>*1</td>
<td>300 Baud</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>1200 Baud</td>
</tr>
<tr>
<td>OFFSET LOCK</td>
<td>41</td>
<td>*0</td>
<td>Offset Unlocked</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Offset locked when Program Inhibit (terminal 15) is connected to DC Common.</td>
</tr>
<tr>
<td>COMMUNICATING TYPE</td>
<td>91</td>
<td>*X0</td>
<td>Transmit count and offset values when Print Request input is energized or a Print Request incoming communication (ASCII &quot;?&quot;) is received.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>X1</td>
<td>Transmit count only as above.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>X2</td>
<td>Transmit offset only as above.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>X3</td>
<td>Allow no transmission of count or offset.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>*0Y</td>
<td>Transmit Scale Factor as above.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1Y</td>
<td>Allow no transmission of Scale Factor.</td>
</tr>
<tr>
<td>PRINT ON RESET</td>
<td>92</td>
<td>*0</td>
<td>No Print on Reset. Print when Print Request input is energized or Print Request communication (ASCII &quot;) is received.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Print on Reset. Print when Reset input is energized. Then automatically reset. No counts are lost with the Print on Reset option.</td>
</tr>
<tr>
<td>SELF-DIAGNOSTIC MODE</td>
<td>40</td>
<td>*0</td>
<td>Return to normal operation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Perform self-diagnostics. Returns to &quot;0&quot; upon successful completion.</td>
</tr>
<tr>
<td>SELECT FACTORY-SET PARAMETERS</td>
<td>43</td>
<td>0</td>
<td>Return to normal operation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Reset all function codes to the factory set values.</td>
</tr>
</tbody>
</table>

**NOTE:** Choices shown with asterisks are the factory set values.

**Figure 16. Function Code Programming Table**

Note: For ratemeter function codes, see pages 53-54.
OPERATION

DISABLING THE FRONT PANEL RESET KEY

Select the Momentary Reset mode (enter “1” in function 82) and install a jumper from the reset input (terminal 17) to DC Common. This disables the Front Panel Reset key and prevents the operator from accidentally resetting the counter.

The jumper may be replaced by a normally closed contact. In this case, the counter is reset externally by opening and closing this contact. If power is interrupted, the counter is not reset when power is reapplied.

INHIBITING PROGRAMMING MODIFICATIONS

The function codes and their values may be accessed and modified whenever the control has power applied, including times when the process being controlled is running.

To avoid accidental change to the function code values, it is recommended that the ability to change them be removed by installing a jumper between the PROGRAM INHIBIT terminal and DC Common on the rear of the control. When installed, all of the functions may be interrogated but not modified.

BE HAZARDOUS TO THE OPERATOR AND/OR THE MACHINERY. USE EXTREME CAUTION. WHENEVER POSSIBLE, STOP THE PROCESS BEFORE ATTEMPTING TO MODIFY FUNCTION CODE VALUES.

CHANGING THE OFFSET VALUE

With the PROGRAM INHIBIT jumper installed, the operator still has complete access to the Offset value.

To change the value of the Offset, follow these steps:

1. Press the “OFFSET” key. The display will show the current Offset value. If the value displayed is the same as the desired value, proceed to step 4.

2. Key in the new Offset value. Upon pressing the first key, the current offset value disappears and the digit which was pressed appears. Each successive digit displays as it is pressed.

3. Press the “ENTER” key. The display blanks for a moment and then redisplay the new offset. This confirms that the new value has been entered.

4. Press the “COUNT” key. The display returns to showing the current count value.
PROGRAMMING PROCEDURES

GENERAL

This section deals with the selection and entry of the function codes and their values. The step-by-step procedure is given for entry of function codes followed by a discussion of the procedure used to determine which combination of features is needed to satisfy a specific application of the control. Once a decision has been made, certain parts of this section may be skipped as indicated.

PROGRAMMING FUNCTION CODES

Function codes may be programmed or interrogated at any time while the control is operating.

⚠️ WARNING

CHANGING FUNCTION CODE VALUES WHILE THE PROCESS IS OPERATING MAY BE HAZARDOUS TO THE OPERATOR AND/OR THE MACHINERY. USE EXTREME CAUTION. WHENEVER POSSIBLE, STOP THE PROCESS BEFORE ATTEMPTING TO MODIFY FUNCTION CODE VALUES.

All functions except the offset value can be protected from accidental change by installing a jumper between the PROGRAM INHIBIT input (terminal #15) and DC Common. When this jumper is installed, the control does not allow modification to any function other than the Offset. All functions may be interrogated with the jumper installed.

To change the operation of a function with the PROGRAM INHIBIT jumper removed, follow these steps:

1. Press the “FUNCTION” key. The display blanks indicating that the key has been pressed.

2. Select the two-digit function code for the desired function. For example, press “62” to select the decimal point location. The display indicates the two digits pressed for the function code. If more than two digits are pressed, the display only retains the last two digit entries.

3. Press the “ENTER” key. The current value for the specified function is displayed. If the value does not need to be changed, a new function may be chosen by returning to step 1. The “COUNT” key may also be pressed to return to the count value.

4. Press the digit keys for the desired entry. Using the above example, a value of 5 would be entered to select the decimal point located as 000.00000. The display shows the value as the key is pressed.

5. Press the “ENTER” key to store the new data. The display blanks temporarily as the control stores the information. If the entry is out of range for the selected function, the control ignores the entry and the previous value is retained.

6. The next function to be interrogated or modified may be specified. If no additional functions need to be selected, the control can be returned to displaying the current count value by pressing the “COUNT” key.

SELECTING MODES OF OPERATION

Count Input Mode

Depending on the configuration of the count sensors, the manner in which the counter operates must be selected. If two discrete sensors or contact closures are utilized, the counter should use the Separate Add and Subtract count mode, the Count with Direction Control mode or the Count Up with Inhibit Control mode. If a single channel shaft encoder is being used, the Count with Direction Control mode or Count Up with Inhibit mode can be selected. If the count source is a quadrature shaft encoder, either of the two Quadrature count modes should be used. Program Function 60 according to Figure 16 to select the count mode.

Reset Mode Operation

The next decision involves the manner in which the control responds to the “RESET” key being pressed or the Reset Input being energized. If the Maintained mode is selected (entering “0” in Function 82), the counter is held at the offset value as long as the key is pressed or the input is energized. When the key is released or the input deenergized, the counter is allowed to operate normally.

If the Momentary mode is selected (entering “1” in Function 82), the counter is instantaneously reset to the offset value when the “RESET” key is pressed or the Reset Input is energized. Then the counter is allowed to operate normally regardless of whether the key or input is maintained or not. The counter is not reset again until either the key is released and pressed again or the input is deenergized and energized again.

21
SCALE FACTORS

The Model 5881-1400 Control includes the ability to scale incoming counts. This means that for each pulse received on the count inputs, a fraction or multiple of that pulse is indicated on the display. Scaling is useful to compensate for wear on measuring wheels, consistent slippage or material stretch, to make conversions between different units of measure (inches to centimeters, for example) or to totalize parts produced from multiple part manufacturing processes (such as 6 parts produced for each operation of a press).

The scale factor can be a number from 0.0001 to 9.9999. This number becomes a factor by which incoming count pulses are multiplied. The result of the multiplication is shown on the front panel display.

<table>
<thead>
<tr>
<th>SCALE FACTOR</th>
<th>COUNT SPEED (PULSES PER SECOND)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal Count</td>
</tr>
<tr>
<td>0.0001 to 0.9999</td>
<td>6,250</td>
</tr>
<tr>
<td>1.0000</td>
<td>7,500</td>
</tr>
<tr>
<td>1.0001 to 1.9999</td>
<td>5,700</td>
</tr>
<tr>
<td>2.0000</td>
<td>6,300</td>
</tr>
<tr>
<td>2.0001 to 2.9999</td>
<td>5,200</td>
</tr>
<tr>
<td>3.0000</td>
<td>5,700</td>
</tr>
<tr>
<td>3.0001 to 3.9999</td>
<td>4,600</td>
</tr>
<tr>
<td>4.0000</td>
<td>5,100</td>
</tr>
<tr>
<td>4.0001 to 4.9999</td>
<td>4,400</td>
</tr>
<tr>
<td>5.0000</td>
<td>4,800</td>
</tr>
<tr>
<td>5.0001 to 5.9999</td>
<td>4,200</td>
</tr>
<tr>
<td>6.0000</td>
<td>4,500</td>
</tr>
<tr>
<td>6.0001 to 6.9999</td>
<td>4,000</td>
</tr>
<tr>
<td>7.0000</td>
<td>4,200</td>
</tr>
<tr>
<td>7.0001 to 7.9999</td>
<td>3,800</td>
</tr>
<tr>
<td>8.0000</td>
<td>3,900</td>
</tr>
<tr>
<td>8.0001 to 8.9999</td>
<td>3,600</td>
</tr>
<tr>
<td>9.0000</td>
<td>3,600</td>
</tr>
<tr>
<td>9.0001 to 9.9999</td>
<td>3,400</td>
</tr>
</tbody>
</table>

Figure 17. Table of Scale Factors versus Count Speed
SCALE FACTORS

ENTERING A SCALE FACTOR

Function 5 selects the Scale Factor. Note that any jumper connected to the Program Inhibit terminal on the rear panel of the counter must first be disconnected before the Scale Factor may be modified. To change the Scale Factor, follow these steps:

1. Press the “FUNCTION” key. The display blanks to indicate that the key has been pressed.
2. Press the “5” key. The display indicates this digit.
3. Press the “ENTER” key. The current value for the Scale Factor is displayed. If the value does not need to be changed, proceed on to step 6 below.
4. Press the digit keys for the desired entry. Note that for a Scale Factor of 1 the entry of 10000 must be made since the scale factor is displayed in the X.XXXX format. The display shows the value as each key is pressed.
5. Press the “ENTER” key to store the new data. The display blanks momentarily as the control stores the information. If a zero is entered as the Scale Factor, the counter defaults to the value of 1.0000.
6. The next function to be interrogated or modified may be specified. If no additional functions need to be selected, the counter may be returned to displaying the current count value by pressing the “COUNT” key.

COUNT SPEED VERSUS SCALE FACTOR

The scale factor entered into the counter has a direct effect on the maximum rate at which the counter can receive count pulses. Generally, the larger the scale factor the slower the counter can receive pulses. A table indicating count speed versus scale factor values is given in Figure 17.

In this table, the Normal Count columns represent the speed at which the counter can receive pulses when it is operating in the Add/Subtract, Count with Direction Control or Count Up with Inhibit Control modes. The Quadrature and Doubled Count columns indicate speed whenever the hardware doubling (jumper installed between the Double Input and DC Common) is utilized.

OPERATION OF THE SCALER

When the counter receives a count pulse, the scaler recognizes that fact and multiplies the 1 pulse by the scale factor. The scaled value, which will be a number from 0.0001 to 9.9999 since this is the range of the scale factor, is added to a resultant total. This resultant is shown on the display. However, the result can have up to four decimal places of value. The display only shows whole increments of counts.

For example, a scale factor of 1.2000 is entered into the counter. For each pulse received, 1.2000 is added to the result. But since the display only indicates whole numbers, after the first pulse it shows “1”. After 5 pulses it shows “6”. This is shown in Figure 18.

<table>
<thead>
<tr>
<th>PULSES RECEIVED</th>
<th>RESULT CALCULATED</th>
<th>DISPLAY VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.0000</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1.2000</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2.4000</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>3.6000</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>4.8000</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>6.0000</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>7.2000</td>
<td>7</td>
</tr>
<tr>
<td>7</td>
<td>8.4000</td>
<td>8</td>
</tr>
<tr>
<td>8</td>
<td>9.6000</td>
<td>9</td>
</tr>
<tr>
<td>9</td>
<td>10.8000</td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>12.0000</td>
<td>12</td>
</tr>
</tbody>
</table>

Figure 18. Pulses Received versus Displayed Value Using Scale Factor of 1.2000

The scaler stores any remaining partial count and adds that to the next scaled pulse value when it is received. This allows accumulation of scaled partial counts.

As a second example, a Scale Factor of 0.5000 is entered into the control. Figure 19 gives a table of pulses received versus displayed value for this example.

As shown, it is when the 10th pulse is received that the display changes from 4 to 5. However, if the counter is started at a value of 5 and is counting down, the first pulse received changes the display to show 4, and the ninth pulse changes the display to 0. But it is the TENTH pulse that causes the output to have an internal value of zero as well. This is because after the ninth pulse, there is a remainder
of 0.5000 counts in the counter and, therefore, the value in the counter is not actually zero until after the next pulse.

<table>
<thead>
<tr>
<th>PULSES RECEIVED</th>
<th>RESULT CALCULATED</th>
<th>DISPLAY VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.0000</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0.5000</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>1.0000</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>1.5000</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>2.0000</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>2.5000</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>3.0000</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>3.5000</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>4.0000</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>4.5000</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>5.0000</td>
<td>5</td>
</tr>
<tr>
<td>11</td>
<td>5.5000</td>
<td>5</td>
</tr>
<tr>
<td>12</td>
<td>6.0000</td>
<td>6</td>
</tr>
<tr>
<td>13</td>
<td>6.5000</td>
<td>6</td>
</tr>
<tr>
<td>14</td>
<td>7.0000</td>
<td>7</td>
</tr>
<tr>
<td>15</td>
<td>7.5000</td>
<td>7</td>
</tr>
<tr>
<td>16</td>
<td>8.0000</td>
<td>8</td>
</tr>
</tbody>
</table>

Figure 19. Pulses Received versus Displayed Value Using Scale Factor of 0.5000

CALCULATING THE SCALE FACTOR

There are four general categories of applications which require scaling. The method of calculating the scale factor differs for each. The categories are:

1. Allowances for wear of measurement devices and material stretch applications.
2. Unit conversions (Typically when the measurement system is set up for measuring in one unit and the part must be made in another, i.e., inches versus millimeters.)
3. Scaling of pulses received from flowmeters or other sensors which produce a non-standard number of pulses per unit of measure.
4. Allowing multiple parts to be made for each operation of a machine.

A discussion of the means of calculating the scale factor for each category and special problems involved follows.

Allowances for Wear or Stretch

Over a period of time a measuring wheel will begin to wear. The wheel allows accurate measurement only when its circumference is a known, fixed value. Thus, as the wheel wears, the error in the measurement increases because the circumference of the wheel becomes less and less. Scaling allows the pulses produced by the pulse generator to which the wheel is attached to be compensated for the decreasing circumference. This allows the useful life of the measuring wheel to be extended, decreasing cost.

In applications where the material stretches or shrinks by a fixed amount, scaling allows compensation for gained or lost material. These applications require that the amount of stretch or shrinkage be known, measurable or calculable and that it be consistent from machine cycle to machine cycle.

In either case, the scale factor is calculated by using the formula:

\[
\text{Desired Display Value} = \text{Actual Pulse Count} / \text{Scale Factor}
\]

In the above formula, the Desired Display Value is the distance that should be measured if the measuring wheel were new or within design tolerance of new. For stretch or shrinkage applications, it is the amount of material fed into the process before the stretching or shrinkage occurs.

The Actual Pulse Count is the number of pulses which the counter receives. For example, if the counter is intended to show 12.00 inches for a given part but the display shows 11.93 inches after measuring the part. Figure 20 shows graphically what takes place in this application.

The shaft encoder in Figure 20 produces 600 pulses per revolution. Doubling is used in the counter to result in 1200 pulses per revolution. The measurement wheel is intended to have a 12.00 inch circumference. This should result in 1 pulse per 0.01 inches.

However, when the process is run, the display consistently shows the parts to be 11.93 inches long. Obviously, the wheel is larger than the 12.00 inch circumference which it should be. Rather than replacing the measurement wheel, a scale factor can be entered to compensate for the discrepancy. Using the formula, the scale factor is calculated by:

\[
\text{Scale Factor} = \frac{12.00" \text{ (Desired)}}{11.93" \text{ (Measured)}} = 1.0059
\]
Figure 20. Wheel Wear Correction Application

Figure 21. Material Stretch Application
With this scale factor entered, the display shows 1200 counts for each part. Thus, each pulse received is worth 1.0059 counts and only 1193 pulses are received by the counter for each part being produced.

For applications where the material is stretched or shrunk, the measurement device may be located on the front end of the process where the unaffected material is fed in. Yet the counter can have a scale factor entered which allows it to measure the finished parts. Figure 21 shows a typical process which results in material stretch.

When parts are produced, the display shows a length of 12.00 with a scale factor of 1.0000. When the part is measured, it is found to be 12.37 inches long. The scale factor needed to provide a proper indication is calculated by plugging these values into the formula:

\[
\text{Scale Factor} = \frac{12.37'' \text{ (Desired)}}{12.00'' \text{ (Pulses Counted)}} = 1.0308
\]

When the scale factor of 1.0308 is entered into the counter, the display shows 12.37 inches as required. Since the material is stretched in the process, each pulse received by the counter is worth 1.0308 counts. Thus, 1200 counts need to be received to measure each 12.37 inch finished part.

<table>
<thead>
<tr>
<th>MEASUREMENT SYSTEM MEASURES IN:</th>
<th>DISPLAY MUST SHOW QUANTITY IN:</th>
<th>SCALE FACTOR TO BE USED:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inches</td>
<td>Centimeters</td>
<td>2.5400</td>
</tr>
<tr>
<td>Centimeters</td>
<td>Inches</td>
<td>0.3937</td>
</tr>
<tr>
<td>Feet</td>
<td>Yards</td>
<td>0.3333</td>
</tr>
<tr>
<td>Yards</td>
<td>Feet</td>
<td>3.0000</td>
</tr>
<tr>
<td>Feet</td>
<td>Meters</td>
<td>0.3048</td>
</tr>
<tr>
<td>Yards</td>
<td>Meters</td>
<td>0.9144</td>
</tr>
<tr>
<td>Meters</td>
<td>Feet</td>
<td>3.2808</td>
</tr>
<tr>
<td>Meters</td>
<td>Yards</td>
<td>1.0936</td>
</tr>
<tr>
<td>Gallons (US)</td>
<td>Liters</td>
<td>3.7854</td>
</tr>
<tr>
<td>Gallons (Imp.)</td>
<td>Liters</td>
<td>4.5428</td>
</tr>
<tr>
<td>Liters</td>
<td>Gallons (US)</td>
<td>0.2642</td>
</tr>
<tr>
<td>Liters</td>
<td>Gallons (Imp.)</td>
<td>0.2201</td>
</tr>
<tr>
<td>Quarts (US)</td>
<td>Liters</td>
<td>0.9463</td>
</tr>
<tr>
<td>Liters</td>
<td>Quarts (US)</td>
<td>1.0567</td>
</tr>
</tbody>
</table>

**Figure 22. Unit Conversion Scale Factor**

**Unit Conversions**

In some cases, the measurement system is set up to measure in one engineering unit but the parts made are produced in a different engineering unit. This may be the difference between ounces and gallons, inches and feet, feet and yards, inches and millimeters, quarts and liters or any other combination. In these applications, the scale factor may be chosen from the table given in Figure 22 or calculated using any standard conversion factor carried out to four decimal places.

**Scaling Pulses Received From Flowmeters or Other Sensors**

Typically, flowmeters generate large numbers of pulses for each unit of measure. Additionally, the number of pulses per unit is usually not easily divisible or massaged to allow a standard counter to increment in a common engineering unit.

The scale factor to be entered into the counter is easily calculated by using the formula:

\[
\text{Scale Factor} = \frac{\text{1 (Unit of Measure)}}{\text{Pulses Produced per Unit of Measure}}
\]

For example, a flowmeter might produce 146 pulses per gallon of flow. If the counter is to count gallons of flow, the incoming pulses must be divided by 146. If the display should indicate whole gallons of flow accumulated, the scale factor is determined by:

\[
\text{Scale Factor} = \frac{1}{146} = 0.0068
\]

If the display should rather show gallons and tenths of gallons, the scale factor may be multiplied by 10 to yield 0.0685. (Note that in this case the decimal point on the counter should be placed between the first and second digits for proper indication of units.)

When the output from other sensors must be scaled, the same formula can be used to calculate the scale factor. It is sometimes easier to change the definition of the terms in order to find the scale factor, however. For example, a quadrature shaft encoder which produces 600 pulses per revolution is used to indicate rotation of a shaft. Usually, rotation is given in degrees with 360 degrees per revolution. If the doubled Quadrature count mode is used, 1200 pulses per revolution are received by the counter. This results in 3.3333 pulses per degree of rotation.
SCALE FACTORS

Given this information, finding the scale factor necessary for proper operation can be confusing. But if the terms of the formula are changed as:

\[
\text{Desired Display Value} = \text{Scale Factor} \times \text{Actual Pulses Received}
\]

Filling in the terms the scale factor is found by:

\[
\frac{360}{\text{Counts Per Revolution}} = \text{Scale Factor} \times \frac{1200}{\text{Pulses Per Revolution}}
\]

With the Scale Factor of 0.3000, the display will indicate 360 degrees per revolution from a 1200 PPR encoder.

Allowing Multiple Parts per Machine Operation
If a single machine operation causes one pulse to be received by the counter and that single machine operation produces several parts simultaneously, the scale factor is simply the number of parts produced per pulse. For example, if six parts are produced per cycle of the machine, a scale factor of 6.0000 should be entered into the control.

In this example, if one of the six cavities requires repair and is not producing parts, the scale factor may be reduced from 6.0000 to 5.0000. This adjustment can be made without resetting the counter. The machine must be stopped, the Program Inhibit jumper removed if installed, and the Scale Factor changed. Then the Program Inhibit jumper may be reinstalled and the process started up again. This allows in-process service and adjustment of machine malfunctions without losing track of how many parts have been produced so far.

It may be desirable in this type of application to have the Program Inhibit terminal wired to a key-lock switch, allowing easier adjustment when necessary.
SERIAL COMMUNICATIONS

Several types of information may be transmitted or received by the counter. The serial communications capability allows the count value, the offset value or both to be printed, remotely displayed, or sent to a host computer or other peripheral device for processing. The characteristics of the communication are controlled by Function Codes.

COMMUNICATION FORMAT
The counter uses a 20 milliamp current loop type of electrical interface for serial communications. The counter has a separate 20 milliamp current loop for incoming communications and another loop for outgoing communications.

Since serial communication (either in or out) is done through only two wires, each character transmitted or received must be generated by a series of on and off states called bits. Each character has its own unique code or sequence of bits that allows the receiving device to understand what character it is receiving. The character “5”, for example, has a series of bits which are different from the series of bits for the character “6”. In fact, eight individual bits are needed to express a single character. Seven bits identify the character itself and the eighth is used for error checking to allow the receiving device to make sure that the previous seven are correct when they are received. This eighth bit is called the parity bit and shows “even parity” to the receiving device when transmitting data. When the counter receives serial data, it ignores the parity bit.

There are several different standard rates at which serial communications occur. Each is a function of the number of bits transmitted per second. The term which defines transmission rate is “Baud,” which is understood to mean “bits per second.” The standard transmission rates the counter can be set up to use are 110 Baud, 300 Baud, and 1200 Baud.

While each character requires eight individual bits to be uniquely expressed, a few additional bits must be sent between characters. These are called “start” and “stop” bits. The “start” bit signifies that this is the beginning of the character and the next eight bits are the character itself. After the character is transmitted, either one or two “stop” bits are sent to indicate that the character has been completely transmitted. When the counter is operating at 110 Baud, two “stop” bits are sent and at 300 or 1200 Baud, one is sent. Thus, at 300 Baud, for example, each character requires ten bits to be transmitted: one “start” bit, eight data bits and one “stop” bit. If information is being communicated at 300 Baud, 30 characters per second are communicated since a total of ten bits per character are required.

The standard set of codes used by the control for communicating information serially is called the ASCII character table. ASCII stands for American Standard Code for Information Interchange. The control uses ASCII codes for all its communications.

A typical character transmitted or received is shown in Figure 23. In this figure, the character is shown with the “start” bit, seven data bits, the even parity bit, and one “stop” bit.

SENDING DATA
Data transmission can be initiated by either of two methods. The first is by connecting the PRINT REQUEST terminal (terminal #16) to DC Common. The second is by a special code transmitted to the control via the serial communications.

Once a transmission has been initiated, the counter will first transmit the “Carriage Return” and “Line Feed” characters (described in the following paragraphs and illustrated in Figure 24) followed by the numeric information selected for printing. The “Carriage Return” and “Line Feed” characters cause the printer to provide spacing between printouts.

When the counter transmits either the actual value or the offset value through the SERIAL DATA OUTPUT (SDO) terminals, it sends the characters “0” through “9” as necessary to express the value. It transmits the most significant digit (MSD) first. For example, if the current value of the counter is 1357, the counter sends the ASCII code for “0” four times since the four most significant digits are blank and have a value of zero, then the code for “1”, then the code for “3”, then “5”, and finally “7”.

After the entire value has been transmitted, the counter sends two more characters. These are called “Carriage Return” (CR) and “Line Feed” (LF). A printer, host computer or other peripheral uses these characters to identify when a transmission is complete. In the case of the printer, the “CR” instructs it to return the printing carriage and the “LF” tells it to advance the paper one line. The “CR” and “LF” are transmitted after each value the counter sends.
The counter normally transmits both the counter value and offset value. Before the values are sent, the counter sends an identifier which indicates what information is to follow. When the counter is connected to a printer, these identifiers are also printed. The label “CNT” is printed before the value of the counter and “OFS” is printed before the offset value. If a decimal point has been specified, the decimal point is inserted into the printout at the appropriate place in both values.

The label “SCA” is printed before the scale factor and a decimal point always appears after the first digit when the scale factor is printed.

Figure 24 shows graphically how a typical value is transmitted. Each block shown consists of the bit organization as indicated in Figure 23.
Figure 25 shows a sample printout when the control has been set up to print both the counter and offset values with a decimal point before the second digit, and the scale factor.

<table>
<thead>
<tr>
<th>CNT</th>
<th>123456.78</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFS</td>
<td>500000.00</td>
</tr>
<tr>
<td>SCA</td>
<td>1.0000</td>
</tr>
</tbody>
</table>

**Figure 25. Typical Printout of Transmitted Values**

If all values are to be transmitted, the count value is always transmitted first and the scale factor last.

The counter can be programmed to automatically transmit the selected values when it is reset. This mode is selected by entering a "1" in Function 92. Upon pressing the "RESET" key or having the Reset input energized, the counter internally stores the count value, then resets the counter. Once the counter is reset, the stored count value is transmitted. This allows the count value to be recorded while the process is running without losing any counts.

When the Print on Reset mode is selected, the Print Request input may be energized or the ASCII "?" received through serial communication to cause a printout without resetting the counter.

**RECEIVING DATA**

The counter can receive a command through the serial communications input which instructs it to automatically transmit the information of the counter or offset. This command has the same effect as energizing the Print Request input. The ASCII character "?" asks the counter to send its data.

In addition, the value of the offset or the scale factor can be changed through the serial communication input when a new value is received from a remote offset peripheral, a host computer or another compatible peripheral. The new value for offset must be preceded by the ASCII character "A" which informs the counter that a new offset value is forthcoming. After the 1 to 8 digits for the new offset are received, the ASCII character "**" must be received to tell the counter that the end of the preset value has been received. When the "**" is received, the new offset is automatically entered.

A new scale factor must be preceded by the ASCII character "S" and followed by an ASCII "**". The value may be 1 to 5 digits and may or may not contain a decimal point. If the decimal point is not received, the 5881-1400 automatically inserts one.

A sample command to change the offset via serial communications is shown in Figure 26. Note that each block shown contains the bit organization as indicated in Figure 23.

The Baud rate of the incoming serial communications is the same rate as set for the outgoing communications. Any serial data the counter receives is ignored if it is not either preceded by an "A", "S" or a "?". The counter ignores any decimal points which are received during a transmission of a new offset, but inserts the decimal point automatically after the new offset has been entered upon receipt of the "**".

**SERIAL COMMUNICATIONS SET-UP**

**Communications Speed**

If the counter is to communicate to or from another device, it must be set up to do so. The first question

![Diagram of START TRANSMISSION and STOP TRANSMISSION with ASCII codes and time](image)

**Figure 26. Typical Offset Change Serially Communicated**
is: what speed of communication is required by the other device? There are three possible answers acceptable: 110 Baud, 300 Baud, and 1200 Baud. One of these three speeds should be chosen based on the capabilities of the other transmitting or receiving device. For example, if the Durant President Printer is to be receiving information from the counter, 1200 Baud should be selected by entering a “2” in Function 90. Note that the President printer must also be set up to receive at this rate.

If one of the several standard 5880 series peripherals (like the Remote Preset Terminal or the Remote Display Unit) is connected, see the Installation/Operation manuals for these devices to determine the necessary communication speed setting.

**Communication Type**

If the control is to transmit information to a receiving device, the second question is: what information does the receiving device need to know? The control allows one of eight answers. The current count value, the offset value, the scale factor, or any combination may be transmitted. Enter a value in Function 91 to select according to the table in Figure 27.

Selection is made by combining one of the 4 possible values for “Y” with one of the 2 possible values for “X”. For example, if only the current Count value is to be printed, the entry for Function 91 is “11”. If all values should be printed, enter a “00”.

**Print on Reset**

The third question concerning serial communication is:

When the control is reset, should it also print? If the control should automatically print when reset, enter a value of “1” in Function 92 to select the Print on Reset mode.

If a printout is not desired when the control is reset, enter a “0” in Function 92.

<table>
<thead>
<tr>
<th>Function 91 Value</th>
<th>COUNT (Always transmitted first)</th>
<th>OFFSET</th>
</tr>
</thead>
<tbody>
<tr>
<td>“X0”</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>“X1”</td>
<td>√</td>
<td>(No transmission)</td>
</tr>
<tr>
<td>“X2”</td>
<td>(No transmission)</td>
<td></td>
</tr>
<tr>
<td>“X3”</td>
<td></td>
<td>(No transmission)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SCALE FACTOR</th>
<th>COUNT (Always transmitted first)</th>
<th>OFFSET</th>
</tr>
</thead>
<tbody>
<tr>
<td>“OY”</td>
<td>√</td>
<td>(No transmission)</td>
</tr>
<tr>
<td>“1Y”</td>
<td>(No transmission)</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 27. Selection of Values to be Transmitted using Function 91**
APPLICATION EXAMPLES

GENERAL
This section provides several typical applications for the control. Each gives a description of the process, details how the process works, and indicates which features are utilized to satisfy the requirements. Where necessary, a sketch and/or wiring diagram is also provided.

Application examples utilizing the Durant series 5881-1400 counter are given as a means of illustrating control applications. Consequently, complete information sufficient for installation and operation purposes is not necessarily given. The information has been checked and is believed to be entirely reliable. However, no responsibility is assumed for inaccuracies.

POSITIONING APPLICATION
Description
A saw blade must be positioned accurately to cut material to selected widths. The saw is mounted to a 4-pitch (4 turns per inch) ball screw which is turned by a reversible motor. The ball screw has a 600 pulse-per-revolution shaft encoder mounted to it. This combination results in the generation of 2400 pulses per inch of movement of the blade. The encoder is a quadrature type which allows the counter to track the movement in either direction.

Operation
The operator uses two pushbutton switches to locate the saw. One causes the saw to move in the forward direction and the other in the reverse direction. When a new position is to be established, the operator first causes the saw to return to a "Home" position, indicated by a permanently mounted limit switch. This switch resets the counter to zero. Then the operator moves the saw out, away from the Home position until the proper dimension is shown on the display of the counter. The display should show movement in thousandths of inches. The decimal point is located on the display to indicate .001 inch increments.

Figure 28 provides a sketch of this application.

![Positioning Application Sketch](image_url)
APPLICATION EXAMPLES

Set-up
The ball screw/shaft encoder combination produces 2400 pulses per inch. If the Doubled Quadrature count mode is selected, this increases to 4800 pulses per inch of movement. Since the display should show 1000 counts per inch, the input must be scaled. The calculation of the scale factor is given as:

\[
\text{Desired Display} = 1000 \\
\text{Scale Factor} = \frac{\text{Actual Pulse Qty.}}{4800} = 0.2083
\]

Thus, the scale factor of 0.2083 is entered into the control through Function 5. The Doubled Quadrature count mode is selected by entering a value of “3” into Function 60. With Quadrature count modes, the jumper must be installed between the Double Input and DC Common on the rear of the counter. The decimal point should be located before the third least significant digit, therefore a “3” is entered into Function 62.

No printing is needed so Functions 90, 91 and 92 are left unchanged. The Reset input should operate in the Maintained mode to allow the counter to be reset any time the saw is in the Home position. This is selected by entering “0” in Function 82.

Figure 29 provides a wiring diagram for this application.

Figure 29. Positioning Application Wiring
APPLICATION EXAMPLES

WIRE FAULT DETECTION APPLICATION

Description
As electrical wire is extruded, the insulation is also extruded around the wire. As part of the inspection procedure, the finished insulated wire is passed through a sparker. In the sparker, a high potential electric spark is generated around the wire. If the spark penetrates the insulation and reaches the conductor, the insulation is faulty. The sparker generates a contact closure whenever a failure is detected.

Figure 30. Fault Detection Sketch

Figure 31. Wire Fault Detection Wiring
APPLICATION EXAMPLES

Sections of wire with faulty insulation must be removed from the wiring being produced as they are not saleable. In order to pinpoint the location of the failures so that those sections may later be removed, a printout is needed which indicates the footage at which the fault exists. During the rewinding process, the operator can determine from this printout how much good wire exists between faults. This allows the operator to choose the correct size of spool for each good section of wire.

Operation
As the extruder is started up, the operator resets the counter to zero by pressing the Reset key on the front panel. The wire being extruded is wrapped around a 12-inch circumference measurement wheel which is attached to a 100 PPR shaft encoder. This arrangement will produce 100 pulses per foot of wire. Since the extrusion line does not stop unless an emergency condition arises, the encoder has a single channel output. Directional monitoring is not necessary because the wire never stops or reverses.

Whenever the sparker generates an output signal indicating a fault, the counter transmits its value to a printer. The counter is not reset after each printout since the location of the faults along the continuous length is required. A Durant President Printer is wired to the serial communications output of the control to provide the printout. To provide fastest response, 1200 Baud is specified as the serial communication speed on both the counter and the printer.

Figure 30 provides a sketch of this application.

Set-up
The display should show length of the wire in whole feet. Thus, the input to the counter must be scaled. Since 100 pulses per foot are generated and the display should show one count per foot, the scale factor needed is 1/100 or 0.0100. This is entered in Function 5. Since the counter only needs to count up, the Add/Subtract count mode is selected by entering a "0" in Function 60. The output of the shaft encoder is wired into the Count Input 2 terminal. Since nothing is connected to the Count Input 1 terminal, the Low Frequency 1 terminal should be connected to DC Common to provide maximum noise immunity.

No decimal point is needed since the display indicated length in whole feet, therefore, a value of "0" is entered in Function 62. The printout is generated whenever the sparker provides a contact closure. The contact is wired into the Print Input of the counter. 1200 Baud communication speed is selected by entering a "2" in Function 90. Print on Reset is not desired so a "0" is entered in Function 92. Only the count value is desired on the printout. A value of "11" is entered in Function 91 to select this. The Reset key is used to reset the counter and the counter should remain reset until the key is released. To select this, a "0" is entered in Function 82.

Figure 31 provides the wiring diagram for this application.

PRODUCTION MONITOR APPLICATION

Description
An automatic machine produces piece parts. It is desirable to know how many parts per hour are being produced. A printout is generated by a counter connected to a printer and receiving an hourly print signal from the plant timeclock system. The machine also tests the parts being produced and any found to be defective are subtracted from the total.

Operation
A sensor is mounted on the machine which detects when a part has been produced. An additional sensor detects when that part is defective. The counter is reset at the beginning of the shift by a set-up person or the shift supervisor.

A Durant President printer is connected to the serial communications output of the counter to provide the printout. To provide fastest response, both the counter and the printer are set to operate at 1200 Baud.

Set-up
Each sensor generates one pulse per part. Thus a scale factor of 1.0000 is entered into Function 5. Since the counter must add parts produced and subtract defective parts, the Add/Subtract count mode is selected. The Parts Produced sensor is wired into Count Input 2 and the Defective Parts sensor into Count Input 1. The machine produces about 100 parts per minute so both Count Inputs can operate at low frequency. No decimal point is
APPLICATION EXAMPLES

necessary since the display indicates good parts produced. Doubling is not required. Communications speed is 1200 Baud and the counter should print on reset so that the number of parts produced each hour is printed. The reset key can be maintained.

To select all of these options, “0” is entered into Functions 60, 62 and 82. A “2” is entered in Function 90, a “10” in Function 91 and a “1” in Function 92.

Figure 32 provides the wiring for this application.

CONNECTING A TOTALIZER TO OTHER 5880 FAMILY CONTROLS

Description
In many cases, a totalizer may be used to provide production monitoring when another control from the 5880 series is producing parts. Typical cases are shown in Figures 33 through 35. In Figure 33, the totalizer is counting how many sheets are produced by the 5882 control. Figure 34 shows the totalizer counting how many stacks of sheets are made by the 5884 control and in Figure 35 the totalizer is counting how many boxes full are produced.

Operation
In each case, the totalizer counts pulses generated by one of the outputs from the other control. Since the totalizer increments in each of these applications, the output of the control is wired into the Count Input 2 of the totalizer and the Add/Subtract count mode is selected.

The front panel Reset key of the totalizer may be used to reset the totalizer by the shift supervisor. A printer can be optionally connected to the totalizer to provide hardcopy printout.

Figure 32. Production Monitor Wiring
APPLICATION EXAMPLES

Figure 33. Totalizer as a Sheet Counter

Figure 34. Totalizer as a Stack Counter
APPLICATION EXAMPLES

Set-up
To select the Add/Subtract count mode, enter a "0" in Function 60. In most cases, the rate of count pulses received by the totalizer from the other control(s) will slow. Therefore, both Low Frequency jumpers should be installed. No decimal point is necessary so a "0" is entered in Function 62.

If a printout or other communication is desired, Functions 90, 91 and 92 should be set as required. The Reset key may be momentary or maintained and Function 82 should be set as necessary for the desired mode.

Figures 36 and 37 show typical connections between the totalizer and other 5880 series controls.

---

Figure 35. Totalizer as a Box Counter
Figure 36. Counting Output Pulses From Other 5880 Series Controls
Figure 37. Operating a Totalizer in Parallel to Other 5880 Series Controls for Part Counting
TROUBLESHOOTING

GENERAL

Most problems encountered when applying the control are due to wiring errors, improperly set Function codes, and sensors which are not correctly installed. This section provides guidelines for the detection and correction of these types of problems. Additionally, a description of the diagnostic program included in the control is discussed.

BEFORE APPLYING POWER TO THE EQUIPMENT, RECHECK ALL WIRING TO INSURE PROPER CONNECTIONS. MAKE SURE THE AC LINE VOLTAGE IS CONNECTED ONLY TO SCREW TERMINALS #25, #26, #27 AND #28. CONNECTING AC POWER TO ANY OTHER SIGNAL TERMINALS WILL CAUSE SEVERE DAMAGE TO THE CONTROL.

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>POSSIBLE CAUSES</th>
<th>REMEDIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display does not light when AC power is turned on.</td>
<td>1. No power applied on terminals #25, #26, #27 and #28.</td>
<td>1. Check wiring, fuses and primary AC source.</td>
</tr>
<tr>
<td></td>
<td>2. Terminals #25, #26, #27 and #28 improperly jumpered.</td>
<td>2. Check jumper installation.</td>
</tr>
<tr>
<td></td>
<td>3. Short between terminals #19 or #20 and DC Common.</td>
<td>3. Immediately disconnect AC power supply, check wiring.</td>
</tr>
<tr>
<td>Counter does not increment or decrement when sensor is activated.</td>
<td>1. Sensor malfunction, improperly installed or connected.</td>
<td>4. Check sensor wiring, installation and operation.</td>
</tr>
<tr>
<td></td>
<td>2. Incorrect count mode selected for type of sensor being used.</td>
<td>2. Check function code diagram (Fig. 16) for proper value selection for Function 60.</td>
</tr>
<tr>
<td></td>
<td>3. Reset input (terminal #17) connected to DC Common.</td>
<td>3. Check wiring.</td>
</tr>
<tr>
<td></td>
<td>4. Low frequency select terminals (terminals #11 and #13) connected to DC Common when sensor generates count pulses less than 1 msec long.</td>
<td>4. Disconnect low frequency terminals.</td>
</tr>
<tr>
<td>Counter counts in wrong direction.</td>
<td>1. Quadrature shaft encoder outputs A and B reversed.</td>
<td>1. Reverse wiring on inputs 1 and 2 (terminals #14 and #10).</td>
</tr>
<tr>
<td></td>
<td>2. Add and subtract signals reversed.</td>
<td>2. Reverse wiring on inputs 1 and 2 (terminals #14 and #10).</td>
</tr>
<tr>
<td></td>
<td>3. Improper count mode selected for sensor configuration utilized.</td>
<td>3. Check function code diagram (Fig. 16) for proper value selection for Function 60.</td>
</tr>
<tr>
<td></td>
<td>4. Polarity of up/down control signal reversed when Count With Direction Control mode is selected.</td>
<td>4. Invert up/down control signal on terminal #10 with an external relay or transistor.</td>
</tr>
</tbody>
</table>

Figure 38. Troubleshooting
<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>POSSIBLE CAUSES</th>
<th>REMEDIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Counter accumulates too many counts.</td>
<td>1. Electrical noise causing extra counts. 2. Loose wires between sensors and count inputs. 3. Sensor generating extra pulses due to vibration, oscillation, chatter or jitter.</td>
<td>1a. Check sensor lead installation to insure they are not bundled with other power wiring. 1b. Connect low frequency select terminals (terminals #11 and #13) to DC Common if pulses from the sensor are longer than 1 msec. 1c. Use shielded cable for wiring sensors to Count Inputs (terminals #10 and #14) and connect the shield to terminal #32. 2. Check external sensor wiring. 3. Check sensor mounting and motion of machine to determine if these characteristics cause extra counts. Use Quadrature encoders where applicable.</td>
</tr>
<tr>
<td>No printout or incorrect printout is generated when the control is connected to a printer.</td>
<td>1. No AC power applied to printer. 2. Printer improperly set up. 3. Serial communications output incorrectly wired to the printer. 4. Baud rates of control and printer not set up to the same value.</td>
<td>1. Check AC power connections and fuse in printer. 2. Check printer DIP switches for correct setup. (See printer operation manual.) 3. Check that the SDO+ (terminal #36) on control is connected to SDI- on printer and SDO- (terminal #35) is connected to SDI+. 4. Check that the Baud rates of the control and the printer are the same. (The 6070 printer must have power turned off and on after the DIP switches have been set to change the Baud rate.)</td>
</tr>
</tbody>
</table>

Figure 38. Troubleshooting (continued)
TROUBLESHOOTING

CHECK-OUT PROCEDURE

If the control does not perform satisfactorily, check all connections, proceed through the troubleshooting chart on the previous pages, and check all function codes for proper set-up according to the table given in Figure 16. If these tests proceed correctly and the control is still not properly functioning, remove ALL wiring from the back of the control and proceed through the following steps. If the control fails to function in any of the steps, return it to Durant Products, 901 South 12th Street, Watertown, WI 53094, Attention: Repair Department. Enclose a letter describing the malfunction.

Power Input
Connect 115 VAC between terminals #25 and #26. Jumper terminal #25 to terminal #28 and jumper terminal #26 to terminal #27. The display should flash for a short period of time and then remain lit. Place electrical tape over terminals #25 through #28 to prevent electrical shock during the next tests.

Keyboard
Press the “FUNCTION” key, the display should blank. Press “43” which the display should indicate. Press ENTER, the display should show “0”. Press “1” which the display should indicate. Press “ENTER”, the display should flash “0” and the “COUNT” indicator for a short period of time then remain lit.

Count Up
Make a momentary connection between terminals #10 and #12. The display should increment several counts. Make a connection with a short piece of wire between terminals #11 and #12 and repeat the count test between terminals #10 and #12. Retain the connection between terminals #11 and #12.

Count Down
Make a momentary connection between terminals #14 and #12. The display should decrement several counts. Make a connection with a short piece of wire between terminals #13 and #12 and repeat the count test between terminals #14 and #12. Retain the connection between terminals #13 and #12. Decrement the counter until the display indicates less than “5”.

Reset
Press the “RESET” key and the display should show “0”.

Offset
Press the “OFFSET” key and the display should show “0”. Press the “5” key, which the display should indicate. Press the “ENTER” key. The display should blank for one half second then remain lit. Press the “COUNT” key, the display should indicate the previous count value. Press the “RESET” key. The count value should change to “5”.

Again press the “OFFSET” key and the display should show “5”. Press the “0” key, which the display should indicate. Press the “ENTER” key. The display should blank for one half second then remain lit. Press the “COUNT” key, the display should indicate the value “5”. Press the “RESET” key, the display should show “0”.

INTERNAL DIAGNOSTICS

The control has several internal diagnostic routines which allow it to self-test various operational characteristics. When power is applied, the control tests its memory to determine if it has retained all of the values and function code parameters previously entered. It also tests to insure that all of the internal memory is functional. During these self-tests, the display is blanked. Since the tests are performed very quickly, the user usually does not notice the short delay on power-up.

The user also has the ability to initiate the control self-test diagnostics at any time. Function code 40 is used to initiate the diagnostics. If the control fails any of the diagnostic routines, either on power-up or upon manual command, the display will flash a number indicating which of the six self-tests failed. If no failures are found, the control returns automatically to normal operation.

NOTE

The self-diagnostics should not be performed while the process being controlled is running. The control responds to count pulses but ignores any incoming control signals while the diagnostics are operating.
Description of the Diagnostics
The diagnostics which are included and their related test numbers are as follows.

#1 - ROM (Read Only Memory) 16 Bit Checksum
#2 - Internal RAM (Random Access Memory) Bit Test
#3 - Non-Volatile RAM Read/Write Bit Test
#4 - Non-Volatile RAM Store Test
#5 - Non-Volatile RAM 8 Bit Checksum
#6 - Watch Dog Timer (1.3 Seconds) Timeout

ROM (Read Only Memory) 16 Bit Checksum - Test #1
This test determines if the permanent memory which controls how the control operates is good.

Internal RAM (Random Access Memory) Bit Test - Test #2
This routine tests the temporary workspace memory used for normal operation and communication. If a failure occurs, the counter may change or lose values or operating characteristics unexpectedly.

Non-Volatile RAM Read/Write Bit Test - Test #3
This test checks the memory which permanently stores the operating characteristics and values when a power outage occurs.

Non-Volatile RAM Store Test - Test #4
This test insures that the non-volatile memory accurately stores and retrieves the programmed operating characteristics and values upon a power outage. If a failure of this type occurs, the counter will operate correctly but could change its values or operating characteristics upon a power failure or power drop-out.

CAUTION
TO INSURE PROPER OPERATION
CHECK ALL FUNCTION CODE VALUES
BEFORE STARTING THE PROCESS.
NOTE THAT A TEMPORARY POWER
INTERRUPTION MAY CHANGE THE
VALUES OF FUNCTION CODES DURING
THE PROCESS IF TEST #4 HAS FAILED.

Non-Volatile RAM 8 Bit Checksum Test - Test #5
A checksum test is performed on the non-volatile memory to insure that none of the information stored was changed while the control was unpowered. If this test fails, check all function code values and the values of the counter and preset to insure they are correct. Then disconnect and reconnect power to perform this test again. If the test fails the second time, return the counter for repair.

Watch Dog Timer (1.3 Seconds) - Test #6
While the control is operating, an internal Watch Dog Timer is incremented every millisecond. Under normal operation, the control automatically resets the Watch Dog Timer at least once per second. If the control would malfunction during operation, the Watch Dog Timer may time out (depending on the type of malfunction) and an error code of “6” flashes on the display. If this type of failure occurs, run the diagnostics using Function 40. Excessive electrical interference may cause this type of failure without damage to the control or the operating characteristics. If the diagnostics find no other fault, it is reasonable to assume that the control is fully operational, unless this failure is recurring.

OPERATION OF DIAGNOSTICS
When power is applied, the control begins by performing tests #1, #2, #3 and #5. If all of these pass, the counter is ready to operate as indicated by flashing the count value on the display at one half second intervals for four seconds, then remaining lit.

To select the self-diagnostic mode, specify Function code 40 and enter a value of “1”. The control immediately turns on all display segments and LED indicators for 2 seconds. Then the display blanks and the control steps through all five tests. If all five pass, the control begins a display and LED test routine. This routine sequences through flashing the numbers “0” through “9” on the displays, alternates the Preset and Count LED indicators and moving the decimal point from digit to digit. When the display sequence is finished, the control shows the count value and the Count indicator is lit.

NOTE
The self-diagnostics should not be performed while the process being controlled is running. The control responds to count pulses but ignores any incoming control signals while the diagnostics are operating.
TROUBLESHOOTING

Performing the diagnostic routines does not affect the Function code parameters. Thus, when the diagnostics are finished, the control retains all of the operational characteristics previously programmed.

WHAT TO DO IF THE CONTROL FAILS A DIAGNOSTIC TEST

If the control flashes a single digit number continuously on power-up or when the self-diagnostics are performed, it indicates which one of the tests has failed. When the number displayed is “4”, “5”, or “6”, the control can be allowed to operate by pressing the FUNCTION key to clear the display.

⚠️ WARNING

RUNNING THE COUNTER AFTER A FAILURE HAS BEEN DETECTED CREATES A SERIOUS RISK TO THE OPERATOR AND/OR MACHINERY.

As a minimum safety precaution, the Function code Default mode (Function 43) should be selected (enter a value of “1”) and the Function codes reprogrammed. This will insure that the failure has not altered any of the operating characteristics of the counter. Selecting the default parameters with Function 43 also performs the power-up self test, which could give another failure indication (for tests #1, #2 or #3). If this occurs, return the control for repair immediately.

Address units to be repaired to:

Durant Products
901 South 12th Street
Watertown, WI  53094

ATTENTION: REPAIR DEPARTMENT
GENERAL DESCRIPTION

Model 58815-400 has a 1/Tau ratemeter added to all of the other functions of the count control. The counter and ratemeter features of this unit operates simultaneously at all times.

The ratemeter allows an indication of the speed of the process based on the period of the pulses received at the count inputs. The ratemeter uses only up-count pulses when the counter is used in the Reset to Zero mode, and only down-count pulses when it is used in the Reset to Preset mode. The ratemeter function determines the frequency of the pulses by a calculation which measures the amount of time that elapses between pulses. Ratemeters which use this type of rate calculation are known as “One-over-Tau” ratemeters. The calculation includes a multiplication by an adjustable constant or “Meter Factor” in order to have the ratemeter display a value in units of measurement that relate to the process such as Feet Per Minute, Revolutions Per Minute, Products Per Hour, Inches Per Second, etc.

For higher frequency operations, the ratemeter will average a number of pulses in order to maintain a display update time within the range of 0.5 to 3 seconds. The calculation is based on a sample of 1, 3, 10, 30, 100, 300, 1000, or 3000 pulses. The sample size can be selected automatically or manually.

For lower frequency operations, the ratemeter will allow a sample time of up to 90 seconds. This means that a valid rate display can be obtained when the input frequency is as low as one pulse every 90 seconds (0.011 Pulses Per Second).

These units can be programmed to power up with either COUNT or RATE displayed. Pressing the COUNT key displays the count value and pressing the “4” key displays the RATE value. The unit can also be programmed to automatically alternate the display between COUNT and RATE. The RATE function can be programmed to fix the decimal point in a specified position or allow it to float. In the floating decimal point mode, the display will show four significant digits.

When the serial communication feature of the 5882 is used, the RATE value is transmitted with the prefix “RTE” followed by the rate value, including the decimal point in the proper location, if applicable.

SPECIFICATIONS

Models which have the ratemeter option have slightly reduced maximum count speed. Note that the values below are replacements for the values found in the specification section of this manual.

The maximum count speed of scaled President counters is determined by the Scale Factor selected. The table below shows the maximum count speed for different scale factors and count modes.

<table>
<thead>
<tr>
<th>58815-400</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCALE FACTOR</td>
</tr>
<tr>
<td>.0001 - .9999</td>
</tr>
<tr>
<td>1.0000</td>
</tr>
<tr>
<td>1.0001 - 1.9999</td>
</tr>
<tr>
<td>2.0000</td>
</tr>
<tr>
<td>2.0001 - 2.9999</td>
</tr>
<tr>
<td>3.0000</td>
</tr>
<tr>
<td>3.0001 - 3.9999</td>
</tr>
<tr>
<td>4.0000</td>
</tr>
<tr>
<td>4.0001 - 4.9999</td>
</tr>
<tr>
<td>5.0000</td>
</tr>
<tr>
<td>5.0001 - 5.9999</td>
</tr>
<tr>
<td>6.0000</td>
</tr>
<tr>
<td>6.0001 - 6.9999</td>
</tr>
<tr>
<td>7.0000</td>
</tr>
<tr>
<td>7.0001 - 7.9999</td>
</tr>
<tr>
<td>8.0000</td>
</tr>
<tr>
<td>8.0001 - 8.9999</td>
</tr>
<tr>
<td>9.0000</td>
</tr>
<tr>
<td>9.0001 - 9.9999</td>
</tr>
</tbody>
</table>

Figure 39. Maximum Count Speeds

RATE INDICATION ACCURACY: ± .1% or ±1 least significant digit, whichever is greater.

MINIMUM COUNT INPUT FREQUENCY FOR VALID RATE INDICATION: 1 pulse per 90 seconds (0.011 Hz).
OTHER SIGNIFICANT CHANGES OVER MODELS 58820-400 AND 58821-400

The Presidents with Rate have the addition of a “Rate” LED which is lit whenever the Rate value is being displayed. Additionally, the “4” key is used to display the Rate value and is so labeled.

The count value can be “frozen” on the display whenever the “Count” key is pressed and held. When the key is released, the display updates continuously to the current Count value, as normal. This allows a reading to be taken as a process is operating, since it effectively stops the display without affecting operation of the process and/or control functions.

The display does not latch when a serial communications interrogation of the counter is performed, nor does it latch when a Print on Reset function is initiated. The display will only latch when the Print Request/Display Latch terminal on the rear panel is energized or when the “Count” key is pressed and held.

RATEMETER THEORY OF OPERATION

The ratemeter function of the President counters calculate the rate to be displayed by measuring the time it takes for two consecutive pulses to be received on one of the count inputs. For count modes where the count function is resetting to zero and counting up, the ratemeter uses pulses that increment the count display. If a decrementing pulse is received by the counter, it is ignored by the ratemeter. Likewise, for count modes where the count function is resetting to the Preset and counting down, the ratemeter uses pulses that decrement the count display. If an incrementing pulse is received by the counter in this case, it is ignored by the ratemeter.

On units with count scaling, the rate function can be programmed to incorporate or ignore the COUNT scale factor. This capability is referred to as RATE TRACKING. To simplify the ratemeter explanations which follow, it will be assumed that the RATE TRACKING feature is programed in the INPUT PULSE MODE (ignore scale factor).

Figure 40 shows how the ratemeter measures the time between pulses. The Rate is calculated by using the formula: Rate - 1/Pulse Time.

METER FACTORS

In order to allow the ratemeter display to show a value that relates to the process and represents the desired units of measurement (i.e., Feet Per Minute, Tons Per Hour, Sheets Per Second, Parts Per Hour, etc.), the ratemeter adjusts the rate value by a meter factor. This is done by using the formula:

\[
\text{Display Value} = \frac{\text{Rate (in Pulses Per Second)}}{\text{Meter Factor}}
\]

IMPORTANT: The Meter Factor can be almost any value. However, it is possible to select a value which will cause the Rate display to overflow. This means that the display is not capable of showing all of the significant digits of the resultant Rate value. Usually, this is caused by the combination of a large meter factor and a high pulse rate on the count inputs.

The Ratemeter indicates the overflow condition by lighting all of the decimal points on the display when the Rate value is being viewed. The value shown on the display is the correct Rate value except that

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![Figure 40. Measuring the Pulse Time](image-url)
the most significant digit or digits are not visible because they have been effectively rotated off the display to the left. The error display is reset when the overflow condition ceases to exist, which would result when the incoming pulse rate is reduced, or the Meter Factor is changed.

In addition to the error display when an overflow condition occurs, the message “RTE MU_ER” (which stands for Rate Multiplier Error) is transmitted through the serial communications port whenever a print request is made. A print request is initiated by energizing the Print Request terminal on the rear of the counter or by sending an ASCII “?” to the counter through the serial communications port.

**Automatic Period Averaging**

When the pulses are presented to the counter at faster frequencies, the ratemeter automatically accumulates time for a number of pulses so that a greater accuracy of the measurement can be achieved. The ratemeter will switch from timing one pulse to accumulating the time for a group of 3, 10, 30, 100, 300, 1000, or 3000 pulses, depending on the frequency of the input. The ratemeter selects the appropriate range to allow the display update time to remain within the range of 0.5 to 3 seconds. This avoids display flicker for high frequency signals and allows a faster update time for very slow signals.

Figure 41 shows how time is accumulated for a series of pulses when the pulse frequency is sufficiently high to cause the ratemeter to use an averaging range of 3. The rate is then calculated by using the formula:

\[
\text{Pulse Quantity Rate} = \frac{\text{Accumulated Time}}{\text{Number of Pulses}}
\]

**Forced Period Averaging**

In some applications, it may be desirable to bypass the automatic selection of the period averaging. Typically, this is true when the pulses being generated by the process are not equally spaced. An example of this is when products or boxes are being placed on a conveyor somewhat randomly and it is desired to know the parts per hour being produced. In this case, measuring individual times between consecutive items will yield a rate display that will vary directly with the varying space between the items. But, by averaging the time it takes for 10 or 30 items to pass by on the conveyor, the display can show AVERAGE parts per hour and remain fairly stable.

While it is possible to select the MINIMUM number of pulses to average, the ratemeter will still automatically adjust to a higher averaging range if it receives pulses too quickly for the selected range. The manual selection only picks the minimum number of pulses to average. The ratemeter will never automatically adjust to an averaging range lower than that selected manually.

When an averaging range is selected manually, the ratemeter does not update the display until the selected quantity of pulses has been received. For example, if a range of 10 is selected manually and pulses are being received at a rate of one per second, the display will not update for 10 seconds.

**IMPORTANT:** When a Forced Period Averaging value is used, the number of pulses which are to be averaged must be received within 90 seconds. If 90 seconds elapses before the minimum average quantity of pulses has been received, an error condition is generated.
RATEMETER OPERATION (Model 58815-40X Only)

For example, if an Averaging Range of 300 is selected, 300 pulses must be received within 90 seconds for the ratemeter to be able to generate a rate display. If the pulse quantity is not satisfied within 90 seconds, the ratemeter will display an error condition indicated by having the display digits blank and all of the decimal points lit. The error display is reset the next time that the ratemeter updates the display.

In addition to the error display when an Averaging Range error condition occurs, the message “RTE AV_ER” (which stands for Rate Averaging Error) is transmitted through the serial communications port whenever a print request is made. A print request is initiated by energizing the Print Request terminal on the rear of the counter or by sending an ASCII “?” to the counter through the serial communications port.

Zero Indication Timeout

For very low frequency count signals (less than 1 pulse per second), the display on the ratemeter updates every time it receives a pulse. It is capable of providing an accurate rate display value when the pulse rate is as slow as one every ten seconds. However, when the pulses stop completely, the ratemeter must have some means of knowing when to set the display to zero.

For this purpose, the Zero Indication Timeout is included. This internal timer is reset each time a pulse is received. But, if no pulse is received before the timer completes its time duration, the ratemeter sets the display to show zero. The time value is adjustable from 1 to 90 seconds in one second increments.

CONFIGURATION PROCEDURE

Decimal Point

Decide at which location on the display the decimal point should be located when the rate value is displayed. Then refer to the table in Figure 43 and enter the value for the desired location in Function code 63.

If you choose to have the ratemeter automatically locate the decimal point, enter a value of “9” in Function Code 63. When this option is selected, the ratemeter automatically locates the decimal point to maintain at least four significant digits of display value. The decimal point will shift right or left as the pulse rate increases or decreases.

<table>
<thead>
<tr>
<th>Func. 63</th>
<th>Decimal Point Location</th>
<th>DP#</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>(NONE) XXXXX.</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>XXX.XX</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>XXX.XX</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>XX.XXX</td>
<td>1000</td>
</tr>
<tr>
<td>4</td>
<td>X.XXX</td>
<td>10000</td>
</tr>
<tr>
<td>9</td>
<td>Floating-4 significant digits</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure 42. Decimal Point Location

Calculating the Meter Factor

The meter factor required to obtain a desired resulting display can be calculated by using the formula:

\[ \text{M.F.} = \frac{\# \text{ Seconds Per Time Unit} \times \text{DP#}}{\# \text{ Input Pulses Per Item}} \times (x2 \text{ if Count Doubling is Used}) \]

Where:

- \# SEC. PER TIME UNIT: Items per Second=1, Items per Minute=60, Items per Hour=3600.
- DP# (DECIMAL POINT NUMBER): Number determined by Decimal Point Location. Refer to Figure 43.
- \# INPUT PULSES PER ITEM: Number of pulses per item. Double this value if Count Doubling is used. Items can be Revolutions, Feet, Gallons, etc.

The Meter Factor must then be expressed in scientific notation. This means that it must be expressed as a number less than “1” raised to a power of 10. For example, a meter factor of 10.34 would be expressed as 0.1034 times ten to the second power (since the decimal point was shifted two positions to the left). The resultant value entered into the Meter Factor Function Code (Function 64) would be 10342. Note that the last digit is always the power of ten and the display would show this value as “1034.2” with the decimal point flashing once per second.
RATEMETER OPERATION (Model 58815-40X Only)

Example 1:
A rotating shaft normally operates at approximately 600 RPM. A magnetic proximity sensor is used to monitor the shaft and produces one pulse per revolution. The display should show whole RPM (Func 63 = 0).

TIME UNIT: Minute = 60 secs.
DP# (XXXX,) = 1
PULSES PER REV = 1

\[ 60 \times 1 \]

Meter Factor = 1 = 60 = \(0.6000 \times 10^2\)

Function 64 should be programmed as “6000.2”

However, in irregular processes where the pulses are spaced at random intervals, the ratemeter will show widely varying values when it is operating at low speeds. In these applications, it is advisable to establish the minimum number of pulses to average, to avoid a fluctuating display value.

Selection of the averaging range will depend on how fast the process is running and how much variation will be seen in the spacing of the pulses. In most cases where minimum averaging is required, the range will be selected by trial and error to minimize the amount of fluctuation of the display value. Start at a low average range and gradually increase until the display seems moderately stable from update to update.

To select an average range, refer to Figure 43 and enter the appropriate value into Function Code 65.

<table>
<thead>
<tr>
<th>Minimum Pulse Average Qty.</th>
<th>Function 65 Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No minimum (automatic)</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>30</td>
<td>3</td>
</tr>
<tr>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>300</td>
<td>5</td>
</tr>
<tr>
<td>1000</td>
<td>6</td>
</tr>
<tr>
<td>3000</td>
<td>7</td>
</tr>
</tbody>
</table>

Figure 43. Average Ranges and Function 65 Values

IMPORTANT: Selecting a forced averaging range defeats the ability of the ratemeter to maintain an update time of between 0.5 and 3 seconds at lower pulse rates. The display will be updated only after the selected number of pulses have been received, unless the pulse frequency is adequately fast to cause the ratemeter to select a higher averaging range automatically.

Example 4:
A bottling process produces approximately 4000 bottles per hour. The bottles are transferred on a
RATEMETER OPERATION (Model 58815-40X Only)

conveyor. The bottles may be spaced unequally on the conveyor as they pass the sensor. Typically, the rate of 10 bottles can be averaged to determine and display the average production rate. Therefore, the Minimum Forced Averaging Range is adjusted to “10” by entering a value of “2” in Function Code 65.

Calculate the Meter Factor required to display Bottles Per Hour. Use the Floating Decimal Point feature (Func 63 = 9).

TIME UNIT: Hour = 3600 secs.
DP# (FLOATING) = 1
PULSES PER BOTTLE = 1

\[3600 \times 1\]
Meter Factor = \[
\frac{3600}{1} = 3600 = .3600 \times 10^4
\]

Function 64 should be programmed as “3600.4”

Example 5:

Calculate the Meter Factor for a system that is using a 600 pulse per revolution encoder with a 1 foot circumference measuring wheel to monitor the travel of material through a roll former. The counter is in a DOUBLED count mode so that each count is equivalent to .01 inch. The desired rate display is Feet Per Minute with a floating decimal point (Func 63 = 9).

TIME UNIT: Minute = 60 secs.
DP# (FLOATING) = 1
PULSES PER FOOT(x2) = 1200

\[60 \times 1\]
Meter Factor = \[
\frac{1200}{1} = .05 = .0500 \times 10^0
\]

Function 64 should be programmed as “0500.0”

RATE TRACKING

The RATE TRACKING feature of this device allows the user to select whether or not the displayed rate is affected by the COUNT SCALE FACTOR. When Function 68 is set equal to 1 (SCALED COUNT MODE) the rate is affected by the COUNT SCALE FACTOR. When Function 68 is set equal to 0 (INPUT PULSE MODE) the COUNT SCALE FACTOR is ignored by the ratemeter.

In applications where the scale factor is being used to convert pulses to engineering units, it is desirable to use the SCALED COUNT MODE. Any changes that are made to the scale factor are automatically taken into account by the ratemeter. In other words, it is not necessary to re-calculate the Meter Factor each time the Scale Factor is changed when using the SCALED COUNT MODE.

Example 6:

Re-calculate the Meter Factor required for example 3 if the Rate Tracking feature is set to the SCALED COUNT MODE (Func 68=1) and the Count Scale Factor is set to count in whole gallons. Remember, the application involves a flow meter that generates 20 pulses per gallon and it is desired to have the counter count in whole gallons while displaying the rate in whole gallons per minute (Func 63=1).

COUNT SCALE 1 (GALLON)
FACTOR (Func 5) = 20 (PULSES) = .0500

THE METER FACTOR FORMULA FOR THE SCALED COUNT MODE IS:

\[
\text{M.F.} = \frac{\# \text{ SECONDS PER TIME UNIT} \times \text{DP#}}{\# \text{ SCALED COUNTS PER ITEM}}
\]

TIME UNIT: Minute = 60 secs.
DP# (XXXXX) = 1
SCALED COUNTS PER ITEM = 1

\[60 \times 1\]
Meter Factor = \[
\frac{600}{1} = 60.00 = .6000 \times 10^2
\]

Function 64 should be programmed as “6000.2”

If changes are made to the Count Scale Factor for calibration purposes, the Meter Factor will remain “6000.2”.

Power-Up Display Value

In some applications, the normal operating display desired is the Rate display rather than the Count value. The President counters normally power up with the Count value on the display. This would require an operator to press the “Rate” key each time the machine was turned on in order to monitor the rate.

President Ratemeters have the ability to allow the power-up display to be either the Count value or the Rate value. This is done by changing the value of Function Code 67. If it has a value of “0”, the counter
RATEmETER OPERATION (Model 58815-40X Only)

will power up showing the Count value. If it has a value of "1", the Rate will be displayed on power up.

Regardless of which value is showing after power up, the Count value can be viewed by pressing the "Count" key and the Rate value by pressing the "Rate" key. Once one of these keys is pressed, that value will remain on the display until a different selection is made or until power is removed from the counter.

**Alternating Display**

It is possible to program the President Ratemeters to automatically alternate the display between Count and Rate. This allows both items to be monitored without the need to select them from the keyboard. The length of time each item is displayed before switching to the other is selectable from 1 to 9 seconds. Program Function 69 with a number from 1 to 9 to select the Alternating Display mode and the length of time each item is displayed. For example, when Function 69 = 3, Count and Rate will each be displayed in alternating 3 second intervals.

**Communications Type**

President Ratemeters have the ability to transmit the Rate value through the serial communications output. This is in addition to all of the other values that can otherwise be transmitted. If the serial communications output is utilized, refer to the section of the Function code table (Figure 46) dealing with Function Code 91. For the specific model of counter you have to select the desired combination of values to be communicated. Note that when the Rate value is printed, it is preceded by the characters "RTE" which identify Rate.

---

**IN CASE OF DIFFICULTY**

This section deals with difficulties that may be encountered specifically with the Ratemeter function. For problems with functions other than the Ratemeter, refer to the "Troubleshooting" section of the Operator’s Manual.

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>POSSIBLE CAUSES</th>
<th>REMEDIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate display shows a value with all of the decimal points being lit. Displayed value seems incorrect.</td>
<td>Meter Factor set at too high a value for the range of input frequency.</td>
<td>Adjust Meter Factor to a lower value. Typically, this can be accomplished by changing units of measurement of the display value. (i.e., items/minute instead of items/hour).</td>
</tr>
<tr>
<td>Rate display is blank except all decimal points are lit.</td>
<td>Forced Averaging is being used and input frequency is low such that the average quantity is not satisfied within 90 seconds.</td>
<td>Adjust Forced Averaging (Function Code 65) to a lower value.</td>
</tr>
<tr>
<td>Rate display value is incorrect.</td>
<td>1. Improper Meter Factor selected for desired display 2. Incorrect exponent for Meter Factor entered.</td>
<td>1. Recalculate the Meter Factor and enter in Function Code 64. 2. Be sure that the least significant digit of Meter Factor is exponent.</td>
</tr>
<tr>
<td>Rate Display is always zero.</td>
<td>Count pulses being received on incorrect input for operational mode selected.</td>
<td>Insure that pulses are additive when Counter is set to Reset to Zero mode and subtractive when Counter is set to Reset to Preset mode.</td>
</tr>
</tbody>
</table>

Figure 44. Ratemeter Function Troubleshooting Table
### RATEMETER OPERATION (Model 58815-40X Only)

**FUNCTION CODES:** Model 58815-40X has additional Function Codes which are associated with the operation of the Ratemeter. Selection and modification of these Function Codes utilize the same procedures as the other Function Codes.

<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>FUNCTION CODE</th>
<th>ENTRY CHOICES</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratemeter Value</td>
<td>Rate Key</td>
<td>None</td>
<td>Shows current Rate value.</td>
</tr>
<tr>
<td>Ratemeter Decimal Point</td>
<td>63</td>
<td>0</td>
<td>No decimal point is displayed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>XXX.X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>XXX.XX</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>XX.XXX</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>X.XXXX</td>
</tr>
<tr>
<td></td>
<td></td>
<td>*9</td>
<td>Floating decimal point. (Decimal Point is automatically located to maintain four significant digits of display value)</td>
</tr>
<tr>
<td>Ratemeter Meter Factor</td>
<td>64</td>
<td>0001.1 to</td>
<td>.0001 times 10^1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9999.9</td>
<td>.9999 times 10^9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>*1000.1</td>
<td>Factory set value (.1000 times 10^1)</td>
</tr>
<tr>
<td>Minimum Forced</td>
<td>65</td>
<td>*0</td>
<td>Automatic averaging selection (Ratemeter selects appropriate range.)</td>
</tr>
<tr>
<td>Averaging Range</td>
<td></td>
<td>1</td>
<td>Average 3 pulses minimum</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Average 10 pulses minimum</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>Average 30 pulses minimum</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>Average 100 pulses minimum</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>Average 300 pulses minimum</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>Average 1000 pulses minimum</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
<td>Average 3000 pulses minimum</td>
</tr>
<tr>
<td>Ratemeter Zero</td>
<td>66</td>
<td>1 to 90</td>
<td>Seconds of time delay before display resets to zero when no pulses are received on the count input.</td>
</tr>
<tr>
<td>Indication Timeout</td>
<td></td>
<td>*10</td>
<td>Factory set value.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Display Rate Value on Power-Up.</td>
</tr>
<tr>
<td>Rate Tracking</td>
<td>68</td>
<td>*0</td>
<td>INPUT PULSE MODE (Rate is calculated from Unscaled Count signal - Scale Factor does NOT affect Rate).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>SCALED COUNT MODE (Rate is calculated from Scaled Count signal - Scale Factor does affect Rate).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>COINCIDENCE MODE (Rate is calculated from the time period between coincidence outputs of the counter. This allows piece rates to be displayed when the counter is being used to measure out the pieces.</td>
</tr>
</tbody>
</table>

Figure 45. Model 58815-40X Additional Function Codes
### RATEMETER OPERATION (Model 58815-40X Only)

<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>FUNCTION CODE</th>
<th>ENTRY CHOICES</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display Operation</td>
<td>69</td>
<td>0</td>
<td>MANUAL MODE (Press &quot;COUNT&quot; key to display Count. Press &quot;4&quot; key to display Rate.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1-9</td>
<td>ALTERNATING MODE (Display automatically alternates between Count and Rate displays. Number entered is the number of seconds each item is displayed before alternating)</td>
</tr>
<tr>
<td>Transmit Data Select</td>
<td>91</td>
<td></td>
<td>Select a two-digit value for Function 91 which transmits the desired data. The 58815-400 options are shown below.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TENS DIGIT</td>
<td>*0 Transmit Rate &amp; Scale Factor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Transmit Rate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Transmit Scale Factor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>Omit Rate &amp; Scale Factor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>UNITS DIGIT</td>
<td>*0 Transmit Count &amp; Offset</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Transmit Count</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Transmit Offset</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>Omit Count and Offset</td>
</tr>
</tbody>
</table>

**Figure 45. Model 58815-400 Additional Function Codes (continued)**

**NOTE:** Values shown with asterisks are the factory set values.

### METER FACTOR FORMULAS

<table>
<thead>
<tr>
<th>Input Pulse Mode (Function 68 =0)</th>
<th>Scaled Count Mode (Function 68 = 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td># Secs. Per Time Unit x Decimal #</td>
<td># Secs. Per Time Unit x Decimal #</td>
</tr>
<tr>
<td>M.F. = Input Pulses per Item (x2 if Count Doubling Used)</td>
<td>M.F. = # Scaled Counts per Item</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function 63</th>
<th>Decimal Point Location</th>
<th>Decimal #</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>XXXXXX (None)</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>XXXX.X</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>XXX.XX</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>XX.XXX</td>
<td>1000</td>
</tr>
<tr>
<td>4</td>
<td>X.XXXXX</td>
<td>10000</td>
</tr>
<tr>
<td>9</td>
<td>Floating-4 significant digits</td>
<td>1</td>
</tr>
</tbody>
</table>

**Figure 46. Meter Factor Formulas**
GENERAL DESCRIPTION

The 58815-403 is a totalizer with rate. It has built into the unit a voltage to frequency converter that allows an analog input. It still has all the features described in this manual. The analog to frequency specifications can be found in this section.

Figure 47 shows the rear terminal descriptions for the 58815-403 President Series Ratemeter with Analog Input. The gain and offset potentiometers are accessed through the holes on the rear panel.

![Terminal Block Diagram](image)

<table>
<thead>
<tr>
<th>TERM NO.</th>
<th>FUNCTION</th>
<th>TERM NO.</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DO NOT USE</td>
<td>19</td>
<td>DO NOT USE</td>
</tr>
<tr>
<td>2</td>
<td>DO NOT USE</td>
<td>20</td>
<td>+15V DC OUTPUT</td>
</tr>
<tr>
<td>3</td>
<td>HIGH VOLT. INP.</td>
<td>21</td>
<td>DC COMMON</td>
</tr>
<tr>
<td>4</td>
<td>LOW VOLT. INP.</td>
<td>22</td>
<td>DO NOT USE</td>
</tr>
<tr>
<td>5</td>
<td>DC COMMON</td>
<td>23</td>
<td>DO NOT USE</td>
</tr>
<tr>
<td>6</td>
<td>DC COMMON</td>
<td>24</td>
<td>DO NOT USE</td>
</tr>
<tr>
<td>7</td>
<td>CURRENT SELECT</td>
<td>25</td>
<td>120/240 VAC</td>
</tr>
<tr>
<td>8</td>
<td>DC COMMON</td>
<td>26</td>
<td>26 VAC</td>
</tr>
<tr>
<td>9</td>
<td>DC COMMON</td>
<td>27</td>
<td>27 VAC</td>
</tr>
<tr>
<td>10</td>
<td>INP2 (FREQ. OUT)</td>
<td>28</td>
<td>28 VAC</td>
</tr>
<tr>
<td>11</td>
<td>LF2</td>
<td>29</td>
<td>DO NOT USE</td>
</tr>
<tr>
<td>12</td>
<td>DC COMMON</td>
<td>30</td>
<td>DO NOT USE</td>
</tr>
<tr>
<td>13</td>
<td>LF1</td>
<td>31</td>
<td>DO NOT USE</td>
</tr>
<tr>
<td>14</td>
<td>INP1</td>
<td>32</td>
<td>SAFETY GROUND</td>
</tr>
<tr>
<td>15</td>
<td>PGM INHIBIT</td>
<td>33</td>
<td>SDI -</td>
</tr>
<tr>
<td>16</td>
<td>PRINT</td>
<td>34</td>
<td>SDI +</td>
</tr>
<tr>
<td>17</td>
<td>RESET</td>
<td>35</td>
<td>SDO +</td>
</tr>
<tr>
<td>18</td>
<td>DOUBLE</td>
<td>36</td>
<td>SDO -</td>
</tr>
</tbody>
</table>

**NOTE:** Terminal 10 is no longer an input. It is now wired directly into the rate input of the unit and is brought external for calibration of the analog to frequency converter.

---

Figure 47. 58815-403 Terminal Block Diagram
Analog to Frequency Converter
The Analog to Frequency Converter is used to convert single ended variable DC voltage or current signals to a variable frequency. The frequency output signal is a square wave which varies linearly in direct relation to the level of the DC analog input signal. Because the output signal of this converter is an optically isolated NPN transistor, it can be interfaced to a wide range of industrial electronic equipment including most Durant counters and ratemeters.

<table>
<thead>
<tr>
<th>OPERATING ENVIRONMENT</th>
<th>ACCURACY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature: 0 to 50 degrees C</td>
<td>+ or - 1% of full scale</td>
</tr>
<tr>
<td>Humidity: 95% Max (non-condensing)</td>
<td></td>
</tr>
</tbody>
</table>

**INPUT SIGNAL RANGE:**
(Single Ended)
- High V inp.: 0 to 100 Vdc
- Low V inp.: 0 to 13.5 Vdc
- Current inp.: 0 to 35 mA

The Input Signal Range indicates the maximum analog signal which can be applied to the corresponding input terminals without damaging the converter. The usable portion of this total range is dependent upon the gain adjustment and other variable parameters. External resistor can be utilized to interface analog signals that exceed the input signal range.

**SIGNAL INPUT IMPEDANCE**
- High V inp.: 30,000 ohms
- Low V inp.: 3,000 ohms
- Current inp.: 100 ohms

The Signal Input Impedance is not affected by gain or offset adjustments.

**OUTPUT FREQUENCY RANGE**
0 to 1,400 Hz

10,000 Hz is the maximum frequency the converter should be operated at. Exceeding 10,000 Hz output frequency can result in inaccurate operation.

**RESPONSE/STABILIZATION TIME**
10 milliseconds maximum

This is the maximum time required for the output frequency to change and stabilize in response to a step change in the analog input level (within 95% of final output frequency).

**OFFSET RANGE**
- High V inp.: -2 to 17 Vdc
- Low V inp.: -0.02 to 1.7 Vdc
- Current inp.: -0.2 to 17 mA

The Offset is the maximum analog signal level that will result in 0 Hz output frequency. A potentiometer allows this value to be adjusted over the range specified.

**GAIN ADJUSTMENT RANGE**
Input
- High V inp.: 6 to 10.3 Hz/Volt
- Low V inp.: 60 to 103 Hz/Volt
- Current inp.: 6 to 10.3 Hz/Volt

A potentiometer allows the amount of output frequency change per volt or milliamp to be adjusted over the range specified.

**USEABLE INPUT SIGNAL RANGE**
Input
- High V inp.: 0-100V
- Low V inp.: 0-13.5V
- Current inp.: 0-35mA

The useable input signal range is limited by either the maximum signal level of the input or the 10,000 Hz maximum output frequency. Offset can be added to these values up to the maximum signal level of the input.

**OUTPUT TYPE AND ELECTRICAL RATINGS**
Optically isolated NPN Transistor
- 10 mA max, 30 Vdc max
- Saturation voltage: .5 Vdc max.
- Leakage current: 50 na Max

The emitter and collector are not connected to internal circuitry. The output can therefore be wired to sink or source current as required by the application.
APPLICATION PROCEDURE

Applying the Analog to Frequency Converter involves performing the following tasks: Defining and calculating the application requirements, Wiring, and Setup/Calibration. This instruction covers each of these tasks step by step.

STEP 1: DEFINE AND CALCULATE APPLICATION REQUIREMENTS

The following section defines the relationship between the analog input signal level and output frequency. The procedure which follows will determine that the application requirements are within the operating range of the Converter.

A. What is the Maximum Analog Signal Level (MAS)?

B. What Output Frequency is required for the Maximum Analog Signal level (OF)?
TOTALIZER/RATEMETER WITH ANALOG INPUT (Model 58815-403 Only)

C. What is the Maximum Analog Signal Level that requires 0 frequency output (OFFSET)?

D. Calculate Gain required:

\[
\text{Gain} = \frac{\text{QF}}{\text{MAS} - \text{OFFSET}}
\]

E. Use the Gain Adjustment Range Table in the Specification section to verify that the gain required is within the operating range of the Converter. The left column of the table indicates which input must be used.

In most applications where the required gain does not fall within the operating range of the converter, external resistors can be utilized to adapt the converter to the application. Also, scaled counters and adjustable ratemeters can correct for gain mismatch. Consult with the factory if the required gain is out of the converter’s normal range.

STEP 2: WIRING

GENERAL WIRING INFORMATION

1. Mount away from electromagnetic devices such as relays, solenoid valves, motors, and other equipment which generates electrical interference.

2. Keep wire leads as short as possible and separated from high voltage and control wiring.

3. Use shielded cable to connect the analog input signal and the frequency output signal.

4. Earth ground one end of the shields of all shielded cable used and leave the other end of the shield unconnected.

TERMINAL ASSIGNMENTS

10 + 8 OUTPUT: The output is an optically isolated NPN transistor. Terminal #10 is the collector and terminal #8 is the emitter. The output transistor can be wired to sink or source up to 10 mA at 30 Vdc.

8 - DC COMMON: These terminals are connected to the common side of the analog input signal and the common of the internal power supply.

7 - CURRENT SELECT: Connect this terminal to DC Common when the analog signal is a current less than 36 mA.

3 - HIGH VOLTAGE SIGNAL INPUT: Connect the positive side of the analog voltage input signal to this terminal when using the high voltage input range.

4 - LOW VOLTAGE SIGNAL INPUT: Connect the positive side of the analog voltage input signal to this terminal when using the low voltage input range. Connect the positive side of a current input signal less than 36 mA to this terminal.

CAUTION

THE NEGATIVE SIDE OF THE ANALOG INPUT SIGNAL IS CONNECTED, THROUGH A DIODE, TO THE COMMON SIDE OF THE INCOMING POWER SUPPLY. VERIFY THAT THE ANALOG EQUIPMENT WILL NOT BE ADVERSELY AFFECTED.
ANALOG VOLTAGE INPUT WIRING

13.5 VDC MAXIMUM SIGNAL

100 VDC MAXIMUM SIGNAL

ANALOG CURRENT INPUT WIRING

35 MA MAXIMUM CURRENT LOOP SIGNAL

100 MA MAXIMUM CURRENT LOOP SIGNAL

*External 100 ohm, 2 Watt Resistor

Figure 49. Wiring Illustrations
TOTALIZER/RATEMETER WITH ANALOG INPUT (Model 58815-403 Only)

STEP 3: SETUP/CALIBRATION

The following procedure establishes the operating relationship between the Analog Input Signal Level and the corresponding Frequency Output. This procedure must be carefully performed to enable the converter to operate within the specified accuracy range. Equipment to measure the analog signal levels and the output frequency will be needed. Accomplishing this procedure will require that the Offset and Gain potentiometers be adjusted several times until no further adjustment is needed.

A. Set the Analog signal level to a value that is approximately 10% greater than the Offset level. Calculate the desired frequency output for this level.

B. Adjust the Offset potentiometer until the calculated desired frequency is achieved (counter clockwise rotation increases frequency, clockwise decreases frequency).

C. Set the Analog signal level to 90% of the maximum level it will reach in this application. Determine the desired output frequency for this signal level.

D. Adjust the Gain potentiometer until the desired output frequency is achieved (clockwise rotation increases frequency, counter clockwise decreases frequency).

E. If Offset or Gain adjustments were not needed calibration is complete. If adjustment(s) were made repeat the procedure starting with step A.

Before removing the calibration equipment, set the input signal level to 50% of maximum. Verify that the output frequency is 50% ±1% of the maximum frequency. If it is not, repeat the Setup/Calibration procedure.
## TRANSDUCERS

<table>
<thead>
<tr>
<th>Medium Duty Shaft Encoder</th>
<th>Heavy Duty Shaft Encoder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Channel--381500-XXX</td>
<td>Single Channel--48370-XXX</td>
</tr>
<tr>
<td>Quadrature -- 38151-XXX</td>
<td>Quadrature--48371-XXX</td>
</tr>
</tbody>
</table>

60, 100, 120 and 600 PPR are stocked ratios for encoders. Any number from 001 to 600 is available. Substitute the desired PPR for "XXX" in the part numbers.

<table>
<thead>
<tr>
<th>12&quot; Measuring Wheels with 3/8&quot; Bore</th>
<th>Rotary &amp; Lineal Contactor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum Rimmed 20156-301</td>
<td>ES-9513-RS</td>
</tr>
<tr>
<td>Rubber Rimmed 20154-301</td>
<td></td>
</tr>
<tr>
<td>Urethane Rimmed 20144-301</td>
<td></td>
</tr>
</tbody>
</table>

| Connector for Encoder 29729-300     | Mounting Bracket for ES-9513-RS |
|                                     | 40460-400                    |
|                                     | Shown with ES-9513-RS and 12" measuring wheel |

| Connector with 10 Foot Cable 29665-300 |                           |
|                                       |                           |
Serial to Parallel BCD Communications Converter 58801-410

The Serial to Parallel BCD Communications Converter (SPCC) is a serial to parallel BCD adaptor which provides a means of interfacing a Durant counter to a ladder logic based Programmable Control. The SPCC converts the serial data from the counter’s 20ma current loop to eight digits of binary coded decimal data for use by the Programmable Control. The BCD output is connected to the I/O structure of the PC. Several options, conveniently selected by a four position DIP switch, eliminates the need for a special configuration for each different application. The SPCC has a self contained power supply which requires 120VAC power.

Parallel BCD To Serial Communications Converter 58801-411

The Parallel BCD to Serial Communications Converter (PSCC) is a parallel BCD to serial adaptor which provides a means of interfacing a Durant counter with a ladder logic based Programmable Control. The PSCC converts eight digits of binary coded decimal data from a PC to serial data to be input to the Durant counter through the counter’s 20ma current loop. The BCD input is connected from the I/O structure of the PC. Several options, conveniently selected by a four position DIP switch, eliminates the need for a special configuration for each different application. The PSCC has a self contained power supply which requires 120VAC power.

Simultaneous Input Processor

The Simultaneous Input Processor (SIP) is used as an accessory with Durant counters to insure that all counts are recorded when multiple sources of count signal are required (counts can occur simultaneously).

<table>
<thead>
<tr>
<th>Input</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 Input</td>
<td>49990-408</td>
</tr>
<tr>
<td>16 Input</td>
<td>49990-416</td>
</tr>
</tbody>
</table>

Timer Module 48160-440

The Durant Timer Module, 48160-440, provides a series of timed output pulses at a rate selectable by the user. The selection is made by setting a DIP switch located on the side of the module. A variety of pulse rates, from 1,000 pulses per second to 10 pulses per minute, can be set on the switch. The timer module will convert any Durant electronic counter or count control with a high speed (5000 Hertz) input into a timer.

Divider Module 48160-420

The Durant Divider Module, 48160-420, makes it possible for two counters which would ordinarily require two different encoder ratios to be driven from the same encoders.
ACCESSORIES AND REPLACEMENT PARTS LISTS

**Input Signal Conditioner**

The Model 48160-400 Signal Conditioner converts a wide range of input signals to a level that is compatible with Durant Electronic Controls. It will accept differential inputs from 50 millivolts to 400 volts and ground referenced inputs from 2.4 volts to 100 volts.

**Relay Module**

This unit has two relays that may be operated by transistors that are rated to carry at least .075A in a 12-volt circuit. Each relay has DPDT contacts for controlling external loads. The relays are plug-in type for easy replacement. The 12-volt power for the relays is provided from the AC input.

120 VAC input power 51611-400
240 VAC input power 51611-401

**Desk Mounting Kits**

These attractive desk mounting kits fit the Durant Series 5880 count controls for installation on any flat surface. The convenient two piece "snap together" design requires no tools for assembly. Four non-skid rubber feet prevent the control from sliding on the mounting surface. Standard conduit knockouts are provided on the rear of the kit for wiring to the process. The 58802-410 kit fits the 58810-400 Totalizer. The 58802-420 kit fits all other 5880 series count controls.

58802-410
58802-420

REPLACEMENT PARTS

**Replacement Relay Revision 60 - up**

Eaton No.: 38133-202
Aromat No.: JW1FEN-B-DC5V

**Front Panel Spacer**

Adapter to JIC enclosures
All Controls 38820-400
Totalizer (58810-400) 38810-400

**Front Panel Gaskets**

All Controls 28720-216
Totalizer (58810-400) 28720-215

**Mounting Clip**

48433-200

**Screw**

29801-187