TABLE OF CONTENTS

1 General Description
3 Specifications
6 Description of Operating Modes
7 Installation Instructions
11 Installation Instructions/Wiring
16 Operation and Set-Up
19 Serial Communications
22 Application Examples
31 Troubleshooting
37 Accessories and Replacement Parts List
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In the construction of the Control described herein, the full intent of the specifications will be met. Eaton Corporation, however reserves the right to make, from time to time and without prior written notice, such departures from the detail specifications as may be required to permit improvements in the design of the product.

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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 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.

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

The front panel of the control, Figure 1, is framed by a bezel that seals the panel to the mounting surface. The counter has a large, eight-digit high visibility red LED display with a programmable decimal point position and polycarbonate Lexan front face with a “RESET” key.

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 and offset data can be sent and offset 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 RS232, parallel BCD and multiplexed BCD formats.
Figure 2. 5881-0400 Rear Panel

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 counter 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 1.74” H x 5.53” D
(136.7mm W x 44.2 mm H x 140.5 mm D)
Bezel Dimensions:
5.80” W x 2.16” H x 0.17” D
(147.3 mm W x 54.9 mm H x 4.3 mm D)
LIP: 0.2 (5 mm)
Panel Cut-out Dimensions:
5.43” W x 1.77” H
(138 mm W x 45 mm H, DIN)
Mounting Panel Thickness:
0.50” (12.7 mm) maximum
(without optional spacer provided)
0.077” (1.96 mm) 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” (14.2 mm) H
(with programmable decimal point location)

Memory Types:
PROM, RAM, Non-volatile NVRAM

Power Output:
15 VDC, (+1, -2), 100 milliamps
(Output power is available only when the control is powered by AC line.)

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

Offset Range:
8 digits (0 to 99,999,999) (Offset is entered through serial communication only. It 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
0 to 10,000 counts per second (CPS) with Durant Shaft Encoders or solid state sensors with internal pull-up resistor.
0 to 7,500 CPS minimum for sensors with open collector transistor output.
0 to 5,000 CPS when hardware doubling is implemented
0 to 150 CPS when Low Frequency is selected.
SPECIFICATIONS

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
  - 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 selector switches OFF):
  - 110 µsec minimum at 15 VDC (6,800 ohms to +DC)
  - 160 µsec minimum at 13.5 VDC (50,000 ohms to +DC)

- High State (Logical “1”, sensor off or contact open)
- Low Speed (Low Speed selector switches ON):
  - 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 selector switches OFF):
  - 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 selector switches ON):
  - 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)

CONTROL INPUTS:
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.

COUNTER OPERATING MODES:
Reset:
- Reset to zero
- Reset to offset value

Maintained Reset
Momentary Reset

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

COMMUNICATIONS:

Interface Type:
  Dual port 20 milliamp current loop

Speed:
  110, 300 and 1200 Baud, user selectable

Data Type:
  Standard ASCII code

Format:
  Start bit, 7 ASCII data bits, Parity bit, 1 or 2 Stop bits (Even parity for Serial Data Output, no parity for Serial Data Input)

Information Transmitted:
  Count value
  Offset value

Information Received:
  Print request
  Offset value
  Print offset enable and disable
DESCRIPTION OF OPERATING MODES

COUNT MODES
The counter 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 mode 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 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 Mode must be selected via DIP Switch B3 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.

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.

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.

RESETTING TO AN OFFSET VALUE
Entering an offset into the control can be accomplished through serial communications or by following a procedure using the DIP switches on the rear of the unit. Once an Offset value is entered into the counter, it will return to that value each time the “RESET” key is pressed or the Reset input is energized.

Once an Offset is entered into the control, it may be easily removed by following a procedure using the DIP switches on the rear of the unit or by transmitting an Offset value of zero through serial communications to the counter.
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.

![Diagram of panel mounting dimensions]

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.

**Figure 4. Terminal and DIP Switch Designations**
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 8 for the correct fuse to be used in the power input wiring.

TERMINAL ASSIGNMENTS AND FUNCTIONS

#1 - +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.

#2 - 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.

#3, #5 AND #12 - DC COMMON
These terminals are internally connected to the negative side of the DC power supply.

#4 AND #13 - COUNT INPUTS
These two count inputs are used to increment or decrement the counter. Terminal #4 is labeled “COUNT INPUT 1” and terminal #13 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.

#6 - PRINT REQUEST/DISPLAY LATCH INPUT
When the PRINT REQUEST terminal is connected to DC Common, the current count value, the current offset value, or both are immediately transmitted through the SERIAL DATA OUTPUT terminals, #17 and #18. 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 counter continues counting. When the 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 show the current value of the counter when the input is deenergized.

#7, #8, #9 and #10 - AC POWER INPUT
For 115 VAC operation, jumper terminals #7 to #10, and #8 to #9. Connect the AC power line to #7 and #8.

<table>
<thead>
<tr>
<th>COUNT MODE</th>
<th>INPUT 1 (Term. #4)</th>
<th>INPUT 2 (Term. #13)</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. The Double Switch, Dip Switch B3, must be turned ON (closed) for proper quadrature operation.

Figure 5. Count Input Operating Modes
For 230 VAC operation, jumper #8 to #10. Connect the AC power line to #7 and #9.

#11 - RESET INPUT
When terminal #11 is connected to DC Common through an external switch, relay, or sensor, the counter is remotely reset to zero or to the remotely entered offset value. The Reset Input has the same function as the front panel “RESET” key.

#14 - CHASSIS GROUND
This terminal MUST be connected to earth ground to provide product safety. Additionally, connecting this terminal to earth ground provides increased noise immunity. When shielded cable is used for sensors or communications wiring, connect the shields to this terminal.

When the counter 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 whenever possible.

#15 AND #16 - SERIAL DATA INPUT
The serial data input is used to receive new offset values and print requests. The interface used is a standard 20 milliamp current loop with a user selectable Baud rate.

Terminal #15 is the negative side of the current loop and #16 is the positive side. When connecting serial communications between the counter 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.

#17 AND #18 - SERIAL DATA OUTPUT
The counter has serial communications output which may be used to transmit the current count value, the offset value, or both. The Baud rate of the 20 milliamp current loop is user selectable. However, the Baud rate selected must be the same for serial input and serial output communications.

Terminal #17 is the positive side of the output current loop and terminal #18 is the negative side. When connecting serial communications between the counter and any other device, note that SERIAL DATA OUT PLUS (SDO+) from the counter MUST be connected to the SERIAL DATA IN MINUS (SDI-) of the device receiving the data. Likewise, SDO- from the counter must be wired to SDI+ of the receiving device.

INTERCONNECTION
After determining the desired operating mode, select the appropriate figures 6 through 14 for connection diagrams for the application.
INSTALLATION INSTRUCTIONS/WIRING

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.

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**Figure 6. 115 VAC 47/63 Hz Power Connection**

<table>
<thead>
<tr>
<th>Fuse Size</th>
<th>AC Power In</th>
<th>U.S.</th>
<th>European</th>
</tr>
</thead>
<tbody>
<tr>
<td>115 V, 60 Hz</td>
<td>1/8 amp</td>
<td>T125mA, 250 V</td>
<td></td>
</tr>
<tr>
<td>115 V, 50 Hz</td>
<td>1/4 amp</td>
<td>T250 mA, 250 V</td>
<td></td>
</tr>
<tr>
<td>230 V, 60 Hz</td>
<td>1/16 amp</td>
<td>T 60 mA, 250 V</td>
<td></td>
</tr>
<tr>
<td>230 V, 50 Hz</td>
<td>1/8 amp</td>
<td>T125 mA, 250 V</td>
<td></td>
</tr>
</tbody>
</table>
Figure 7. 230 VAC 47/63 Hz Power Connection

Figure 8. 11-16 VDC Power Connection
Figure 9. Count Input Wiring

Figure 10. Transducer +15 VDC Connection
Figure 11. Encoder with Directional Control Count Input Wiring

Figure 12. Add and Subtract Count Input Wiring
Figure 13. Remote Reset Wiring

Figure 14. Serial Communications to Durant Communications Converter
DISPLAY
The eight-digit numeric display indicates the count value. When power is applied to the counter, the display flashes at 1/2 second intervals for 4 seconds. The counter will accept counts during this period.

"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, the counter is reset to zero.

DIP SWITCHES
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 properly setting the DIP switches on the rear panel of the counter as shown in Figure 15. When shipped from the factory, the DIP switches are set as shown with asterisks (*) in the figure.

WARNING
CHANGING DIP SWITCH SETTINGS WHILE THE PROCESS IS RUNNING MAY BE HAZARDOUS TO THE OPERATOR AND/OR THE MACHINERY. USE EXTREME CAUTION. STOP THE PROCESS BEFORE CHANGING DIP SWITCH SETTINGS.

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. Select the desired count input mode by setting DIP switches A1 and A2. If either Quadrature count mode is selected, note that the Double Switch, Switch B3, MUST also be closed.

Double Count Mode
DIP switch B3 allows you to select the single or double count mode of operation. In the single count mode, the counter will increment or decrement on the falling edge of the incoming count pulse. (The falling edge is defined as when the pulse changes state from +DC to DC Common potential.) The double count mode allows the counter to increment or decrement on both the falling and rising edges of the pulse. (The rising edge is defined as when the pulse changes state from DC Common to +DC potential.)

Low Frequency 2
DIP switch B4 allows the user to configure the counter to receive low speed (0-150Hz) or high speed (0-7500 Hz) count pulses on input 2.

Low Frequency 1
DIP switch B5 allows the user to configure the counter to receive low speed (0-150Hz) or high speed (0-7500 Hz) count pulses on input 1.

Reset Input Operating Mode
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, the counter is held at zero 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 accumulate counts normally.

If the Momentary mode is selected, the counter is instantaneously reset to zero when the "RESET" key is pressed or the Reset input is energized. Then the counter can accumulate counts normally regardless of whether the key or input is maintained or not. The counter is not reset again until the key is released and pressed again or the input is deenergized and energized again.

Disabling the Front Panel Reset Key
The front panel Reset key may be disabled from resetting the counter when pressed. To do this, select the Momentary Reset Input Operating Mode by turning on DIP Switch B2. Then install a jumper from the Reset Input, terminal 11, to DC Common.

Alternately, the jumper may be replaced by a Normally Closed contact. In this case, the counter
may be reset externally by opening and closing this contact.

In either case, if power is interrupted to the counter, it will not be reset when power is reapplied.

**Decimal Point Location**
The decimal point may be located between any two digits on the display or omitted. Set DIP switches A3, A4 and A5 to select the decimal point location on the counter display.

**ESTABLISHING AN OFFSET VALUE**
To enter an offset value into the counter, apply a count source to the count inputs and increment or decrement the counter until the desired Offset value shows on the display. Open DIP switch A6 and close switch A7. Press the "RESET" switch on the front panel. Note that if DIP switch B2 has been closed in order to disable the front panel “RESET” switch, it should be opened before the “RESET” switch is pressed.) The new Offset value has now been entered into the counter. Adjust DIP switches A6, A7 and B2 to their former settings.

**RESETTING AN OFFSET VALUE TO ZERO**
Once an Offset value other than zero has been entered into the counter, the Offset may be returned to zero. Disconnect AC power from the counter. Open DIP switch A6 and close switch A7. Press and hold the “RESET” switch on the front panel. (Note that if DIP switch B2 has been closed in order to disable the front panel “RESET” switch, it should be opened before the “RESET” switch is pressed.) Reapply power to the counter while holding the “RESET” switch depressed. Adjust DIP switches A6, A7 and B2 to their former settings.

<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>SWITCH NUMBERS</th>
<th>OPERATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>COUNT OPERATION MODE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>O=OPEN</td>
<td>A1 O*</td>
<td>Count with separate add (Input 2) and subtract (Input 1)</td>
</tr>
<tr>
<td>X=CLOSED</td>
<td>A2 O*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>O X</td>
<td>Count (Input 1) with up/down control (Input 2)</td>
</tr>
<tr>
<td></td>
<td>X O</td>
<td>Count up (Input 1) with inhibit control (Input 2) NOTE: This mode cannot be doubled with double switch.</td>
</tr>
<tr>
<td></td>
<td>X O</td>
<td>Quadrature. NOTE: Double switch (DIP Switch B3) MUST be turned ON.</td>
</tr>
<tr>
<td></td>
<td>X X</td>
<td>Double Quadrature. NOTE: Double switch (DIP Switch B3) MUST be turned ON.</td>
</tr>
<tr>
<td>COUNT DOUBLE</td>
<td>B3 O*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>Single count - count on leading edge of count pulse only. Double count - Count on both leading and lagging edges of count pulse.</td>
</tr>
<tr>
<td>LOW FREQUENCY, INPUT 2</td>
<td>B4 O*</td>
<td>High frequency for input 2 selected. Low frequency for input 2 selected.</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>LOW FREQUENCY, INPUT 1</td>
<td>B5 O*</td>
<td>High frequency for input 1 selected. Low frequency for input 1 selected.</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

Figure 15. DIP Switch Programming Table
## OPERATION AND SET-UP

<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>SWITCH NUMBERS (O=OPEN, X=CLOSED)</th>
<th>OPERATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>RESET INPUT</td>
<td>B2 O*</td>
<td>Maintained reset. Counter remains reset until the reset input is deenergized or the &quot;RESET&quot; key is released.</td>
</tr>
<tr>
<td>OPERATING MODE</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>Momentary reset. Instantaneously resets counter when input is energized or &quot;RESET&quot; key is pressed. Then allows counter to operate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>normally regardless of whether reset input is held energized or &quot;RESET&quot; key is continuously being pressed.</td>
</tr>
<tr>
<td>DECIMAL POINT DISPLAY LOCATION</td>
<td>A3 A4 A5 O* O* O*</td>
<td>No decimal point displayed</td>
</tr>
<tr>
<td></td>
<td>0 O X O X X X X O O X O X O X</td>
<td>00000000.0 000000.00 00000.00 00.00000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000</td>
</tr>
<tr>
<td>COMMUNICATIONS SPEED (BAUD RATE)</td>
<td>A6 A7 O  O</td>
<td>1200 Baud</td>
</tr>
<tr>
<td></td>
<td>O X X X X X X O O</td>
<td>INVALID - DO NOT USE 300 Baud 110 Baud</td>
</tr>
<tr>
<td>PRINT ON RESET</td>
<td>B1 O*</td>
<td>No Print on Reset. Print when Print Request input is energized or Print Request communication (ASCII &quot;?&quot;) is received.</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>Print on Reset. Print as above or when Reset input is energized. Then automatically reset. No counts are lost with the Print on Reset option.</td>
</tr>
<tr>
<td>DIAGNOSTIC</td>
<td>A8 O*</td>
<td>Normal counter operation.</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>Perform self-diagnostics.</td>
</tr>
</tbody>
</table>

Figure 15. DIP Switch Programming Table (continued)
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 DIP switches.

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 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 counter 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 16. 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 #6) to DC Common. The second is by a special code transmitted to the counter 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 17) 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 the 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.

Figure 17 shows graphically how a typical value is transmitted. Each block shown consists of the bit organization as indicated in Figure 16. Figure 18 shows sample printout when the counter has been set up to print both the counter and offset values with a decimal point before the second digit. If both the count value and the offset value are to be transmitted, the count value is always transmitted first.

The counter can be programmed to automatically transmit the count and/or offset values when it is reset. This mode is selected by closing DIP Switch B1. 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 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 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 offset value has been received. When the "*" is received, the new offset is automatically entered.

A sample command to change the Offset via serial communications is shown in Figure 19. Note that each block shown contains the bit organization as indicated in Figure 16.

If only the Count value is desired on the printout, the offset value can be inhibited by serially transmitting an ASCII "." (minus) to the counter. When the counter receives this character, it disables the offset value from being transmitted. Once disabled, the offset value is never transmitted again. The offset value can be restored to the printout by transmitting an ASCII "+" (plus) to the counter. When the counter receives this character, the offset value is permanently restored to the printout, or until the next "." is received.

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" 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 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 setting DIP switches A6 and A7 as shown in Figure 15. 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.

Print on Reset
The second question concerning serial communication is: When the counter is reset, should it also print? If the counter should automatically print when reset, close DIP Switch B1. If a printout is not desired when the counter is reset, open DIP Switch B1.
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 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 ball screw which is turned by a reversible motor. The ball screw has a shaft encoder mounted to it which has been selected in combination with the pitch of the screw. This combination results in the generation of one pulse for each .001" 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 push-button 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 decimal point is located on the display to indicate .001 inch increments.

Figure 20 provides a sketch of this application.

Set-up
Since a Quadrature encoder is being used to track the movement of the saw, the quadrature count mode is selected by turning Switch A1 ON and A2 OFF at the rear panel of the counter. With Quadrature, the Double switch, switch B3, must be

Figure 20. Positioning Application Sketch
APPLICATION EXAMPLES

turned ON. The decimal point should be located before the third least significant digit, thus switch A3 is turned OFF and switches A4 and A5 are turned on. No printing is needed so switches A6, A7 and B1 may remain unchanged. Switch A8 is turned OFF since the diagnostic is not performed during operation of the saw blade. The Reset switch should operate in a maintained mode to allow the counter to be reset any time the saw is in the Home position. This is selected by turning OFF switch B2. Low frequency should not be selected for either count input so switches B4 and B5 are turned OFF.

Figure 21 provides a wiring diagram for this application.

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 electrical 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.

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 faults exist. 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 1 PPR shaft encoder.
This arrangement will produce 1 pulse 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 22 provides a sketch of this application.

Figure 22. Fault Detection Sketch

Figure 23. Wire Fault Detection Wiring
APPLICATION EXAMPLES

Set-up
Since the counter only needs to count up, the Add/Subtract count mode is selected by turning OFF switches A1 and A2 on the rear of the counter. Doubling is not required, thus Switch B3 is turned OFF. Since the single channel of the encoder is wired into Input 2, nothing is connected to Input 1. Therefore, the Low Frequency switch for Input 1, switch B5, should be turned on to provide added noise immunity on that input. No decimal point is needed since the display indicates whole feet of wire. Switches A3, A4 and A5 are turned OFF.

The printout is generated whenever the sparker provides a contact closure. The contact is wired into the Print input of the counter. 1200 Baud is selected by turning switches A6 and A7 OFF. Print on Reset is not desired so Switch B1 is also turned OFF. The diagnostic is not performed while the process is running so switch A8 should be OFF. The Reset key is used to reset the counter and the counter should remain reset until the key is released. To select this, switch B2 is turned OFF. Figure 23 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

Figure 24. Production Monitor Wiring
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**
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 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, Switches B1, B4 and B5 should be turned ON and all others should be turned OFF. Figure 24 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 25 through 27. In Figure 25 the totalizer is counting how many sheets are produced by the 5882 control. Figure 26 shows the totalizer counting how many stacks of sheets are made by the 5884 control and in Figure 27 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,

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**Figure 25. Totalizer as a Sheet Counter**
APPLICATION EXAMPLES

Figure 26. Totalizer as a Stack Counter

Figure 27. Totalizer as a Box Counter
Figure 28. Counting Output Pulses From Other 5880 Series Controls
Figure 29. Operating a Totalizer in Parallel to Other
5880 Series Controls For Part Counting
APPLICATION EXAMPLES

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.

Set-up
To select the Add/Subtract count mode, turn switches A1 and A2 OFF. If no doubling is necessary, Switch B3 should be turned OFF. In most cases, the rate of count pulses received by the totalizer from the other control(s) will be slow. Therefore, both Low Frequency switches, B4 and B5, should be turned ON. No decimal point is necessary so switches A3, A4 and A5 are turned OFF.

If a printout or other communication is desired, switches A6, A7 and B1 should be set as required. Switch A8 should be OFF as the diagnostic is not normally performed. The Reset key may be momentary or maintained and Switch B2 should be set as necessary for the desired mode.

Figures 28 and 29 show typical connections between the totalizer and other 5880 series controls.
**TROUBLESHOOTING**

**GENERAL**

Most problems encountered when applying the control are due to wiring errors, improperly set DIP switches, 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 counter is discussed.

---

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>POSSIBLE CAUSES</th>
<th>REMEDIES</th>
</tr>
</thead>
</table>
| Display does not light when AC power is turned on. | 1. No power applied on terminals #7, #8, #9 and #10.  
2. Terminals #7, #8, #9 and #10 improperly jumpered.  
3. Short between terminals #1 or #2 and DC Common. | 1. Check wiring, fuses and primary AC power source.  
2. Check jumper installation.  
3. Immediately disconnect DC power supply, check wiring. |
| Counter does not increment or decrement when sensor is activated. | 1. Sensor malfunction, improperly installed or connected.  
2. Incorrect count mode selected for type of sensor being used.  
3. Reset input (terminal #11) connected to DC Common. | 1. Check sensor wiring, installation and operation.  
2. Check DIP Switch settings (Fig. 15) for proper value selection.  
3. Check wiring. |
| Counter counts in wrong direction. | 1. Quadrature shaft encoder outputs A and B reversed.  
2. Add and Subtract signals reversed.  
3. Improper count mode selected for sensor configuration utilized.  
4. Polarity of up/down control signal reversed when Count With Direction Counter mode is selected. | 1. Reverse wiring on inputs 1 and 2 (terminals #4 and #13).  
2. Reverse wiring on inputs 1 and 2 (terminals #4 and #13).  
3. Check DIP Switch settings (Fig. 15) for proper value selection.  
4. Invert up/down control signal on terminal #4 with an external relay or transistor. |

**Figure 30. 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.</td>
<td>1a. Check sensor lead installation to insure they are not bundled with other power wiring.</td>
</tr>
<tr>
<td></td>
<td>2. Loose wires between sensors and count inputs.</td>
<td>1b. Use shielded cable for wiring sensors to Count Inputs (terminals #4 and #13) and connect the shield to terminal #14.</td>
</tr>
<tr>
<td></td>
<td>3. Sensor generating extra pulses due to vibration, oscillation, chatter or jitter.</td>
<td>2. Check external sensor wiring.</td>
</tr>
<tr>
<td>No printout or incorrect printout is generated when the counter is connected to a printer.</td>
<td>1. No AC power applied to printer.</td>
<td>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></td>
<td>2. Printer improperly set up.</td>
<td>4. Check that the Baud rates of the counter 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>
<tr>
<td></td>
<td>3. Serial communications output incorrectly wired to printer.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Baud rates of counter and printer not set up to the same value.</td>
<td></td>
</tr>
<tr>
<td>Counter resets to non-zero number.</td>
<td>Offset value has been entered into the counter.</td>
<td>Refer to &quot;RESETTING AN OFFSET VALUE TO ZERO&quot; section on page 17.</td>
</tr>
</tbody>
</table>

Figure 30. Troubleshooting (Continued)
TROUBLESHOOTING

CHECK-OUT PROCEDURE
If the counter does not perform satisfactorily, check all connections, proceed through the troubleshooting chart on the previous pages, and check all DIP Switches for proper set-up according to the table given in Figure 15. If these tests proceed correctly and the counter is still not properly functioning, remove ALL wiring from the back of the control and proceed through the following steps. If the counter 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 #7 and #8. Jumper terminal #7 to terminal #10 and jumper terminal #8 to terminal #9. The display should flash for a short period of time and then remain lit. Place electrical tape over terminals #7 through #10 to prevent electrical shock during the next tests.

Count Mode
Select Add/Subtract Mode by turning DIP Switches A1 and A2 OFF.

Count Up
Make a momentary connection between terminals #13 and #12. The display should increment several counts.

Count Down
Make a momentary connection between terminals #4 and #5. The display should decrement several counts.

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

INTERNAL DIAGNOSTICS
The counter has several internal diagnostic routines which allow it to self-test various operational characteristics. When power is applied, the counter 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 counter self-test diagnostics at any time. DIP Switch A8 is used to initiate the diagnostics. If the counter fails any of the diagnostic routines, either on power-up or upon manual command, the display will flash a number indicating which of the eight self-tests failed. If no failures are found, the counter continues self-testing until DIP Switch A8 is turned off.

NOTE
The self-diagnostics should not be performed while the process being controlled is running. The counter 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
#7-DIP Switch Operating Test
#8-Serial Communications Test

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

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>0</td>
<td>O</td>
<td>0</td>
<td>X</td>
<td>1</td>
<td>O</td>
<td>0</td>
</tr>
<tr>
<td>X</td>
<td>1</td>
<td>X</td>
<td>1</td>
<td>X</td>
<td>2</td>
<td>X</td>
<td>1</td>
</tr>
</tbody>
</table>

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.

Figure 31. Assignment of Displays to Switches for DIP Switch Test
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 counter was unpowered. If this test fails, check all function code values and the values of the counter and offset 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 counter automatically resets the Watch Dog Timer at least once per second. If the counter 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 DIP Switch A8. Excessive electrical interference may cause this type of failure without damage to the counter or the operating characteristics. If the diagnostics find no other fault, it is reasonable to assume that the counter is fully operational, unless this failure is recurring.

DIP Switch Operation Test - Test #7
Proper operation of the DIP Switches can be checked with this manual test. The front panel displays show certain codes which indicate which switches are turned ON or OFF. Each of the first 6 digits on the display indicates a code for one or more of the DIP Switches. Figure 31 shows how the digits on the display are assigned.

DIP Switches may be turned ON or OFF during this test. Whenever a change is made the display reflects the new code for that change.

The displays will indicate digits according to the table in Figure 31.

The DIP Switch Test will continue until the "Reset" key is pressed or two minutes has elapsed, whichever occurs first. A power interruption also aborts the DIP Switch Test.

As an example, if switches A1, A3, A5, A7 and B1 are ON and all others are OFF, the display shows "010251".

Communication Test - Test #8
If the Serial Data Out terminals are jumpered back into the Serial Data In terminals and the Print Input is connected to DC Common, the 5881 performs the Serial Communications Test. This consists of the counter transmitting some information and checking to see if it receives the same information it sent. For proper operation SDO+ (Terminal #17) must be connected to SDI- (Terminal #15) and SDO- (Terminal #18) must be connected to SDI+ (Terminal #16). A jumper must also be installed between the Print Input (Terminal #6) and DC Common.

If the jumper on the print input is not connected, the counter does not perform this test and immediately proceeds on to the next test.

OPERATION OF DIAGNOSTICS
When power is applied, the counter begins by performing tests #1, #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, close DIP switch A8. The counter immediately turns on all display segments and LED indicators for 2 seconds. Then the display blanks and the counter steps through tests 1 through 5 and 7 and 8. If all of these pass, the counter begins a display test routine. This routine sequences through flashing the displays and moving the decimal point from digit to digit. The display test continues until the diagnostic mode select switch is turned off. Otherwise, the display test continues for 2 minutes. Then the counter starts over with test #1 and sequences through the entire diagnostic routine again. This repeats until DIP Switch A8 is turned off.

NOTE
The self-diagnostics should not be performed while the process being controlled is running. The counter ignores any incoming count or control signals while the diagnostics are operating.

Performing the diagnostic routines does not affect the count value or other parameters. Thus, when the diagnostics are finished, the control retains all of the operational characteristics previously programmed. When the diagnostic switch is turned
off, the counter examines all the DIP Switches and changes its operation accordingly.

WHAT TO DO IF THE CONTROL FAILS A DIAGNOSTIC TEST

If the counter 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”, “6” or “8”, the control can be allowed to operate by pressing the RESET 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, check the settings of all DIP Switches for proper set-up. Then disconnect and reconnect AC power. If the counter repeatedly shows a failure indication, return it for repair immediately.

Address units to be repaired to:

Durant Products  
901 South 12th Street  
Watertown, WI 53094  
ATTENTION: REPAIR DEPARTMENT

In order to insure fastest return from repair, please include a detailed description of the problem encountered, its effects and symptoms, and the connections and settings of the switches being used in the application. The note should also include the telephone number and name of the person to be contacted in the event our repair department has any questions. This description should be attached to the unit inside of the shipping container and should be separate from the packing slip.
### ACCESSORIES AND REPLACEMENT PARTS LISTS

<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” Measuring Wheels with 3/8” 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>

<table>
<thead>
<tr>
<th>Connector for Encoder</th>
<th>Mounting Bracket for ES-9513-RS</th>
</tr>
</thead>
<tbody>
<tr>
<td>29729-300</td>
<td>40460-400</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Connector with 10 Foot Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>29665-300</td>
</tr>
</tbody>
</table>
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, eliminate 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>Count</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>49990-408</td>
</tr>
<tr>
<td>16</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

<table>
<thead>
<tr>
<th>Input Signal Conditioner</th>
<th>48160-400</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Relay Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>120 VAC input power</td>
<td>51611-400</td>
</tr>
<tr>
<td>240 VAC input power</td>
<td>51611-401</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Desk Mounting Kits</th>
</tr>
</thead>
<tbody>
<tr>
<td>These attractive desk mounting kits fit the Durant Series 5880 count controls for installation on any flat surface. The convenient two piece &quot;snap together&quot; 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.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>58802-410</td>
<td></td>
</tr>
<tr>
<td>58802-420</td>
<td></td>
</tr>
</tbody>
</table>

### REPLACEMENT PARTS

<table>
<thead>
<tr>
<th>Replacement Relay Revision 60 - up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eaton No.: 38133-202</td>
</tr>
<tr>
<td>Aromat No.: JW1FEN-B-DC5V</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Front Panel Spacer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adapter to JIC enclosures</td>
</tr>
<tr>
<td>All Controls 38820-400</td>
</tr>
<tr>
<td>Totalizer (58810-400) 38810-400</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Front Panel Gaskets</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Controls 28720-216</td>
</tr>
<tr>
<td>Totalizer (58810-400) 28720-215</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mounting Clip</th>
</tr>
</thead>
<tbody>
<tr>
<td>48433-200</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Screw</th>
</tr>
</thead>
<tbody>
<tr>
<td>29801-187</td>
</tr>
</tbody>
</table>