4

Mode 20 – High Speed UP/DOWN Counter

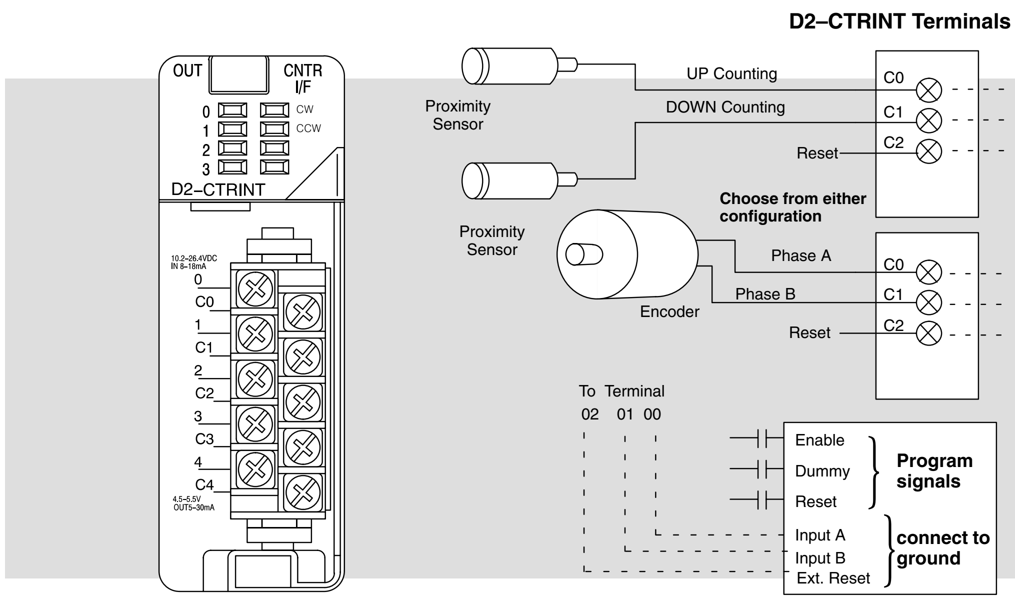
In This Chapter. . . .

Using the UP/DOWN Counter, Mode 20 (DL240/250–1/260 Only)

It is recommended that you read Chapter 1, Getting Started, which introduces the six different modes of operation of the D2–CTRINT module, before selecting a mode. Even though several features can be mixed from several modes, *you must select one of the modes as your primary mode.* Mode 20, UP/DOWN Counter will be the only mode discussed in this chapter.

It is also important to read Chapter 2, concerning the general guidelines for field wiring your device to the module. You may want to refer to Chapter 2 as you learn more about the D2–CTRINT's UP/DOWN counting function.

DL240/250–1/260 UP/DOWN Counter Mode 20



The above diagram and illustration shows points C0 and C1 which are the two primary UP/DOWN counter connecting points for the pulse input devices. Point C2 is the reset input. The counter can be reset either through the operating program using relay ladder logic or they can be reset by an external field device. Points 00 through 03 are the respective *common* connections for the counter inputs and optional external reset. Point 04 and C4 are for pulse output signals and are not used in this mode.

UP/DOWN Counting Overview

Encoders In General

Encoders are used in all types of applications, including machine tooling, semiconductor positioning and multi–axis positioning. In the most general sense, the encoder puts out a certain number of pulses for each revolution of the shaft. Encoders can be easily interfaced to the D2–CTRINT module for accurate position monitoring and control. There are two types of encoders available, incremental and absolute. These encoders have a rotating shaft which are normally coupled (mechanically) to motors for machine control.

The incremental encoder has a pulse output which corresponds to the rotation of the shaft. This pulse output is the encoder resolution corresponding to the number of pulses per revolution. There are two outputs from an incremental encoder, A and B. There is also an output for home position. The encoder outputs can be used for either counting or for direction control (quadrature).

The absolute encoder is used for more precise positioning. The output from the absolute encoder is a binary value relating to degrees per revolution (360/revolution).

Both types of encoders, incremental and absolute, are available from **AutomationDirect**. More information about the encoders is available from both our website and catalog.

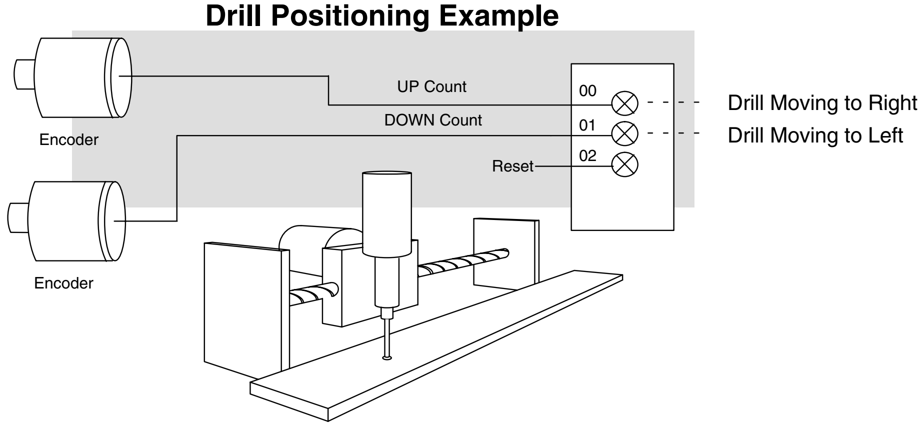
There are two basic ways to use the UP/DOWN counter, either for standard UP/DOWN counting from two separate sources (i.e. single pulse from two encoders) or for quadrature UP/DOWN counting using encoder outputs A and B.

Standard UP/DOWN Counting

The first way, using the D2–CTRINT module as a standard UP/DOWN counter, is commonly used for position control. For example, a drill head may need to be moved in a certain direction horizontally. At the same time, the drill head position may also need to be tracked. This can be done by counting pulses received from two encoders. When the drill moves in one direction, an encoder will increment an accumulated count (UP count). When the drill moves in the opposite direction, a second encoder will decrement the accumulated count (DOWN count). The drill position will be known by looking at the accumulated count at any given time.

Using the high speed positioning example, point 00 would receive signals from an encoder that keeps track of movement in one direction, to the right. Point 01 would keep track of movement to the left via a second encoder. Incrementing and decrementing the UP/DOWN counter can happen simultaneously or during separate intervals of time.

Drill Positioning Example

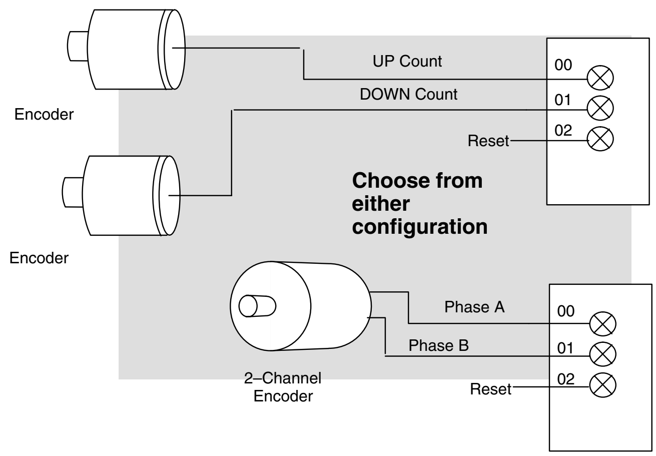


Quadrature UP/DOWN Counting

The second way to use the D2–CTRINT is to keep track of the direction which a motor is turning. This is accomplished by using a quadrature encoder with the A and B outputs connected to the UP/DOWN counter. The A and B pulse trains which are processed have a 90 degree phase difference. This means that one pulse train leads the other pulse train by 90 degrees. From this information, the D2–CTRINT can be configured to know if the shaft is turning clockwise or counterclockwise.

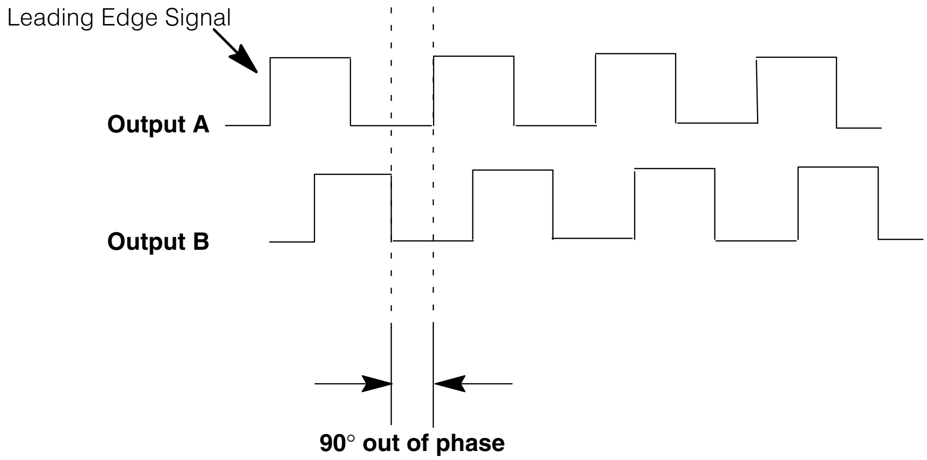
The diagram below, shows both standard UP/DOWN counting and the quadrature UP/DOWN counting being performed with encoders. The encoders shown for the standard UP/DOWN counting could be replaced with photoelectric sensors, or even limit switches.

Quadrature counting, on the other hand, is confined specifically to shaft encoders.

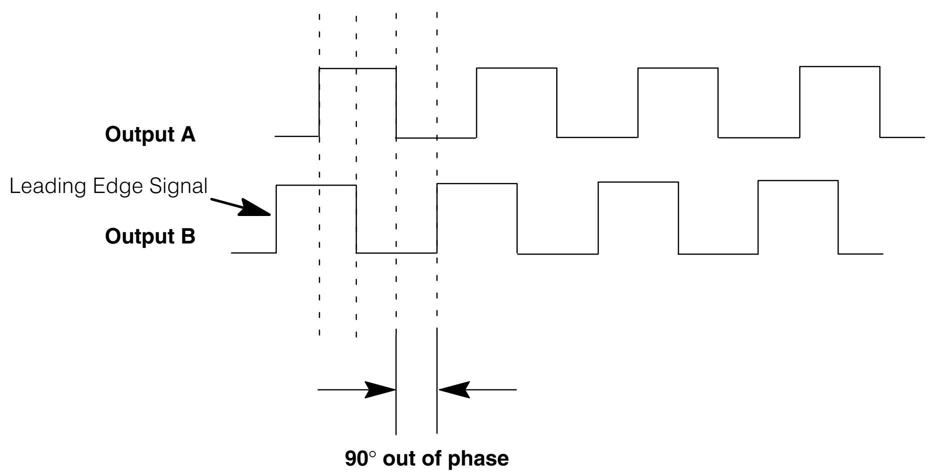


How a Quadrature Encoder Works

As mentioned previously, a quadrature encoder has two outputs, A and B. These outputs can be used to sense position and direction of a motor driven device. This is possible because of the quadrature outputs, A and B, are 90° out of phase to each other as shown in the figure below:



Like any quadrature encoder, four unique logic states are created internal to the encoder. This is based on the rising edge to rising edge (one cycle) on output A or B. The rising edge of Output A, the rising edge of Output B, the falling edge of Output A and the falling edge of Output B form the complete quadrature. In the example above, Output A is the leading signal, and it will cause the counter to count up. This would indicate to the CPU that the motor shaft is turning *clockwise*. However, suppose instead that the signals looked like the diagram below:



Now Output B is the leading signal, and it will cause the counter to count down. This would indicate to the CPU that the motor shaft is turning *counter-clockwise*.

Understanding V-Memory Setup Locations

V-memory location V7633 is the most important of all the reserved memory areas because it stores the numeric value which lets the CPU know which mode has been selected. The following diagram shows the 16-bit word and the various information it stores—including the values used for the Counter Interface Module. The example shown here uses the UP/DOWN counting mode. The lower bits are set to 20 and the upper bits are set to 10 so the battery backup is enabled. Together they form the number 1020.

Memory Location V7633

Bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	0	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**

1 **0** **2** **0**

Miscellaneous Setup
Binary Coded Decimal:

00 = Not Used (default)
10 = Battery Enabled (DL230/240/250–1/260)
20 = Power Up in Run (DL230 only)
30 = Selects both Battery Enable and Power Up in Run (DL230 only)
40 = Mode Change Enable in K–sequence (DL240 only)
50 = Battery Enable and Mode Change Enable in K–sequence (DL240 only)

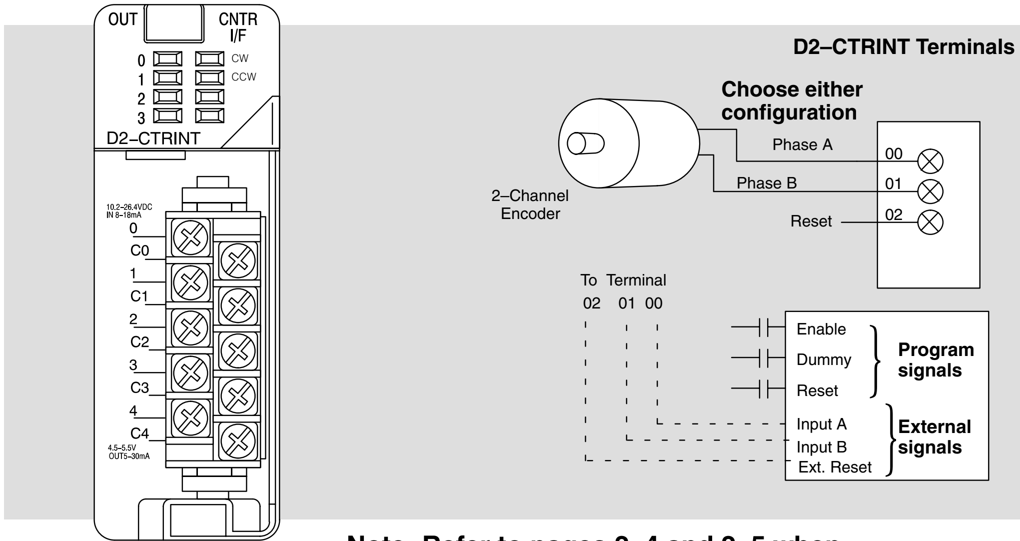
D2-CTRINT Mode Setup
Binary Coded Decimal:

00 = Not Used
10 = UP Counting Mode
20 = UP/DOWN Counting Mode
30 = Pulse Output Train
40 = High Speed Interrupts
50 = Pulse Catching
60 = Discrete Filtered Inputs

NOTE: It is important to look at the entire 16 bits at V7633. If the RLL program only sets the bits in the lower byte when entering the mode value, the upper bits will be overwritten with zeros (0's). Always enter a 4-digit BCD value when writing to V-memory. This way, the proper value will be written into the upper bits.

There are also other V-memory locations which contain High Speed Counter Interface Module setup information for each I/O point. The CPU will automatically configure them with default values for the mode which has been selected.

DL240/250–1/260 Quadrature Counter Configuration



Note: Refer to pages 2–4 and 2–5 when wiring your particular device.

The diagram above shows the physical layout of the front of the module. The actual wire connecting points on the module can be visually related to the various functions that are associated through the default counter configuration.

There are programming examples in this chapter which show how to change some of these defaults.

Default settings with V7633 set to XX20:

V–Memory Location and I/O points on the module	Default Value in DL240/250–1/260	Description
V7634 (point 00)	0002	UP/DWN Input
V7635 (point 01)	0000	Not Used
V7636 (point 02)	0007	Reset
V7637 (point 03)	1006	Discrete Input

The values shown above have the following meaning:

0002 =UP/DOWN quadrature, Absolute counter mode

0007 = External reset input without an interrupt

1006 = Discrete input with 10 ms filter

While discussing memory configuration, it is important to mention the reserved memory for the presets. The default memory locations are shown below.

CPU	Channel 1 (pt.00) & (pt.01)
DL240/250–1/260	V3630 thru V3707

Setting Up the CPU

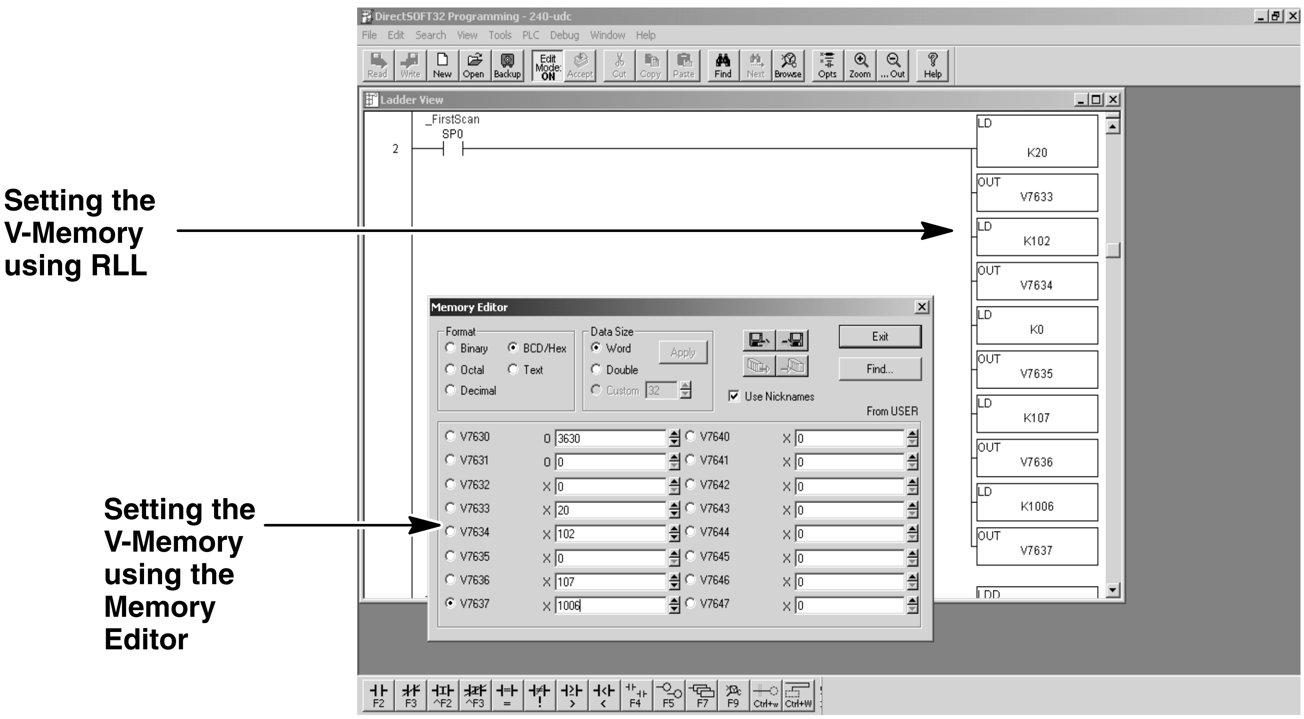
Configuring the V–Memory

The DL240/250–1/260 CPUs check the V-memory to see if there is a High Speed Counter Interface Module present. There will be a hexadecimal number 10, 20, 30, 40, 50 or 60 in V7633 if a module has been properly configured. This is the value which is entered in the RLL program setup. If the CPU finds that a Counter Interface Module is present, other V-memory locations will be checked to see how each point of the module has been configured.

The values can be entered into memory by using either a handheld programmer or by editing them into a control program using ***Direct***SOFT32. The following examples will show how to use ***Direct***SOFT32 to configure the UP/DOWN Counter.

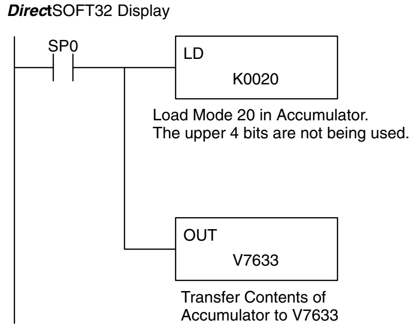
Step 1: Entering the Mode Selected

The UP/DOWN Counter is Mode 20 which is the value to be set into V7633. The following ***Direct***SOFT32 diagram shows the setup procedures for communicating with your DL240/250–1/260 PLC. Refer to the ***Direct***SOFT32 **Programmers User Manual** for more details.



Editing the D2–CTRINT setup at the beginning of the user program is the most efficient method for setting up the counter mode. Should there be a need to change any of the counter setup values after the PLC has been put in the RUN Mode, use the Memory Editor to change the values. These values will only be temporary. They should be put into the program if they are to be used permanently.

The following RLL example shows how to set the UP/DOWN Counter, Mode 20, in V-memory location V7633.



Two commands are needed to put the values into V-memory. The value must first be loaded into the accumulator of the CPU, then the CPU must transfer the value to the memory location. In this case, 20 is to be placed in V7633. This value is loaded into the accumulator, LD K20. The CPU then writes this data to the memory location, V7633, once it reads the OUT command, OUT V7633. Notice that an SP0 contact is used in this rung. This relay is on for the first scan only. Thus, it will load the values in memory initially, thereby keeping the scan time to a minimum

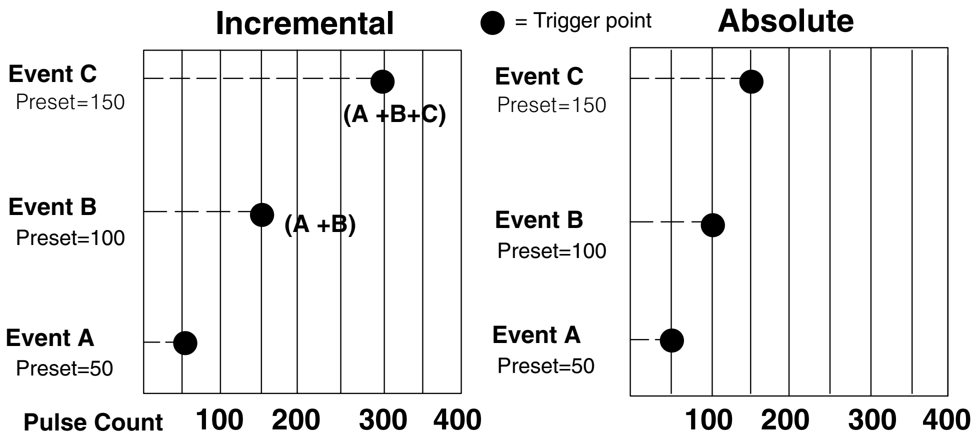
Step 2: Select the Preset Mode

There are two different preset modes to chose from—either Absolute or Incremental. If the default Absolute mode of presets has been accepted, skip this step and go on to Step 3.

To understand the concepts of using the Absolute and Incremental preset modes, it is essential to know some basics about the counter's presets. Inside the PLC's memory up to twenty–four (24) preset values can be setup for each counter. A preset is the number of pulses which are chosen to be counted before an event is to be initiated.

Presets are entered into successive areas of V-memory. With the Absolute mode, the presets are all independent. That is, the counter compares the actual total count received from the D2–CTRINT module to a preset, when the two are equal, the event is triggered. With an Incremental preset mode, however, the presets are related to each other. In such case, the counter reaches preset A and triggers event A, then preset B is added to preset A and that becomes the number of pulses that must be counted before event B is triggered. Preset C is added to the sum of presets A and B and that is the number of pulses required for event C to be triggered. The process of adding all the presets continues until the CPU is notified that there are no more presets to satisfy.

Below is an example showing the difference between using the presets Incrementally and Absolutely.



Assume that a limit switch (SW1) is being connected to one of the high speed counters. The counter is to initiate three different events at certain points in time determined by the pulse count received. Assume that the presets are stored (associated with each of the three events) in successive memory as 50, 100, and 150. In this example, these values are to be attended to in an Incremental fashion. The counter would, in such case, trigger the 1st event when it counts 50 pulses, the 2nd event when it receives 150 pulses total (50 + 100) and the 3rd event when it receives 300 pulses total (50 + 100 + 150).

The result would have been different if the counter had been configured to count in the Absolute mode. In such case, the counter would trigger the 1st event when it counted 50 pulses, the 2nd event when it received 100 pulses and the 3rd event when it counted 150 pulses.

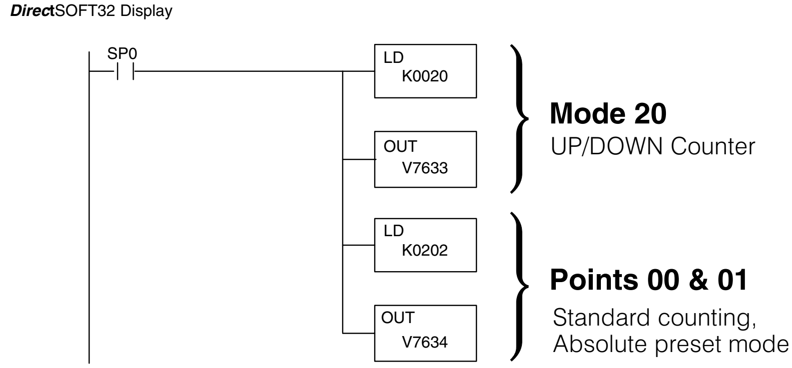
Configuring the Preset Mode

Placing a preset value in memory location V7634 lets the CPU know which preset mode (Absolute *or* Incremental) to use. The same 4-digit hex value in that same position will also indicate whether the select is either standard or quadrature counting. The following values are available:

0002 = Quadrature counting, Absolute preset mode
0102 = Quadrature counting, Incremental preset mode
0202 = Standard counting, Absolute preset mode
0302 = Standard counting, Incremental preset mode

Below is the ladder logic for entering the information for an application where standard UP/DOWN counting is to be used with the Incremental preset mode.

DirectSOFT32 Display

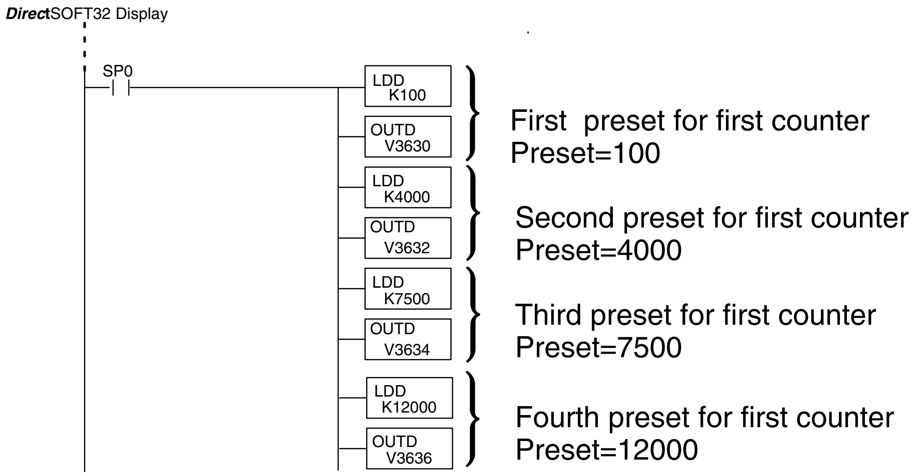


Step 3: The Presets

The final step for setting up the CPU is to configure the presets. There are up to 24 presets available for UP/DOWN counting. These presets can be changed in the relay ladder logic, but are only seen by the counter at a PLC mode change or reset of the counter.

Loading the Presets

The presets are loaded into consecutive V-memory locations, starting with the default memory location of V3630. Use LDD and OUTD instructions as indicated in the example below:



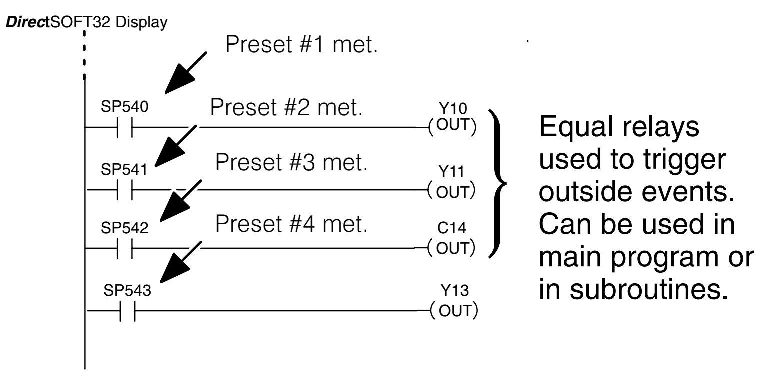
Using Negative Presets

Presets can be changed at any time; but in order for the counter to recognize the changed values, the counter must be reset or the CPU must go through a mode change.

Negative presets can be used, but in order to do so, the MSB in the upper word of the preset must be made HIGH. Example: –250–1 = 80000250.

Triggering Presets to Outside Events

Each of the presets are associated with special relays called equal relays. They can be referenced in your relay ladder logic just like any other relay. Outside events are triggered whenever the preset assigned to a particular relay is satisfied by the pulse count, it closes. Unlike the UP counter Mode 10 (where there are two high speed counters and two sets of equal relays), there is only one UP/DOWN counter and one set of equal relays for Mode 20.



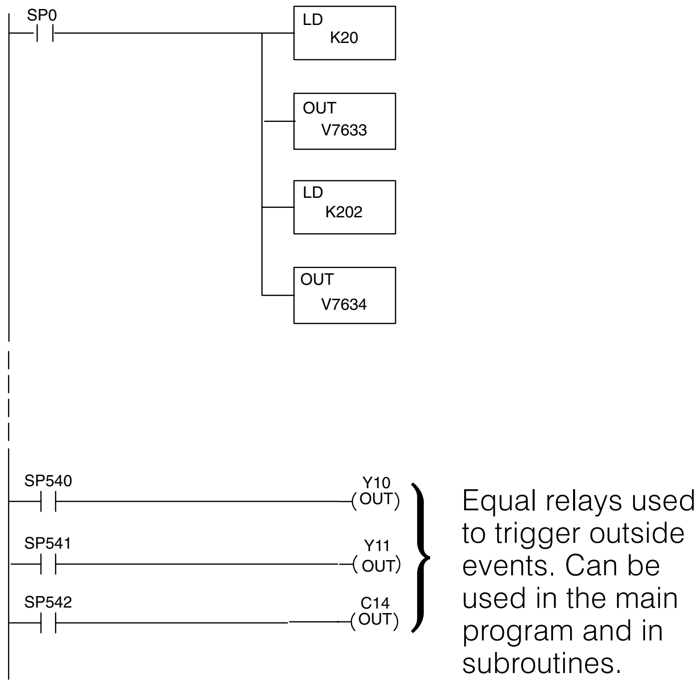
This table shows the label for each equal relay and the default V-memory address assigned to each.

DL240/250–1/260 Equal Relays
Channel 1 (points 00 & 01)
SP540 (V3631/V3630)
SP541 (V3633/V3632)
SP542 (V3635/V3634)
SP543 (V3637/V3636)
SP544 (V3641/V3640)
SP545 (V3643/V3642)
SP546 (V3645/V3644)
SP547 (V3647/V3646)
SP550 (V3651/V3650)
SP551 (V3653/V3652)
SP552 (V3655/V3654)
SP553 (V3657/V3656)
SP554 (V3661/V3660)
SP555 (V3663/V3662)
SP556 (V3665/V3664)
SP557 (V3667/V3666)
SP560 (V3671/V3670)
SP561 (V3673/V3672)
SP562 (V3675/V3674)
SP563 (V3677/V3676)
SP564 (V3701/V3700)
SP565 (V3703/V3702)
SP566 (V3705/V3704)
SP567 (V3707/V3706)

NOTE: Pointers for the start of these addresses are stored by the CPU at V7630. If there is a conflict of addresses because of pre-existing code written to these addresses, change the default block of addresses by placing a different pointer value in V7630. For example, to change the starting address for the relays belonging to Channel 1 to V2500, change the program to write an octal 2500 to V7630. The results are that the CPU will reserve 48 consecutive 16-bit memory addresses (32 bits per preset for the 24 presets available) for SP540 to SP567 equal relays.

The example below shows how the relay labels are used in a relay ladder program. A portion of the program uses three of the equal relays to trigger specific output points.

***Direct*SOFT32 Display**



Also notice that the 0202 is used to tell the CPU that the standard method of counting (as opposed to quadrature counting) is used and each preset is to be related in an Absolute manner (as opposed to an Incremental relationship).

The Other Channels

Filtered Input – Point 03

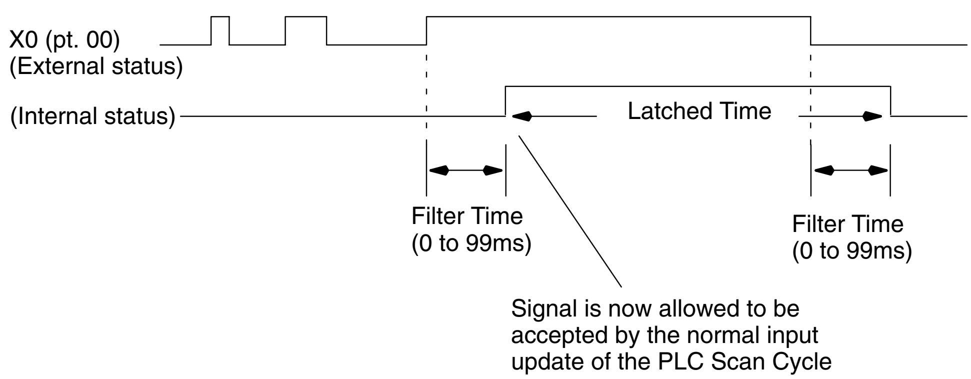
When Mode 20 is selected, the CPU automatically writes the value of 1006 to V7637. The digits 06 means discrete input, and 10 selects a 10 ms filter. Point 03 is setup by default.

Discrete Filtered Inputs

Some applications have inputs from field devices which produce noise. Filtering can help to reduce or eliminate the noise from the inputs caused by switch bounce or other sources.

When an input signal is first detected at point 03, a programmable filter is activated which begins a timed countdown. The ON status of the signal is temporarily prevented from being read by the input update of the CPU. The ON signal must stay present for a certain amount of time for the filter to “time out”.

Referring to the diagram below, once the signal has remained ON for the required time, it is latched and allowed to be accepted by the CPU during the normal input update of the PLC scan cycle. The signal is latched for the remaining duration of the ON signal plus an amount of time equal to the filter time. The filter time can be programmed for 0 to 99ms in 1ms increments. It is set to 10 ms by default. The filtering time can be changed or a different function, Pulse Catching, can be selected for this input point.



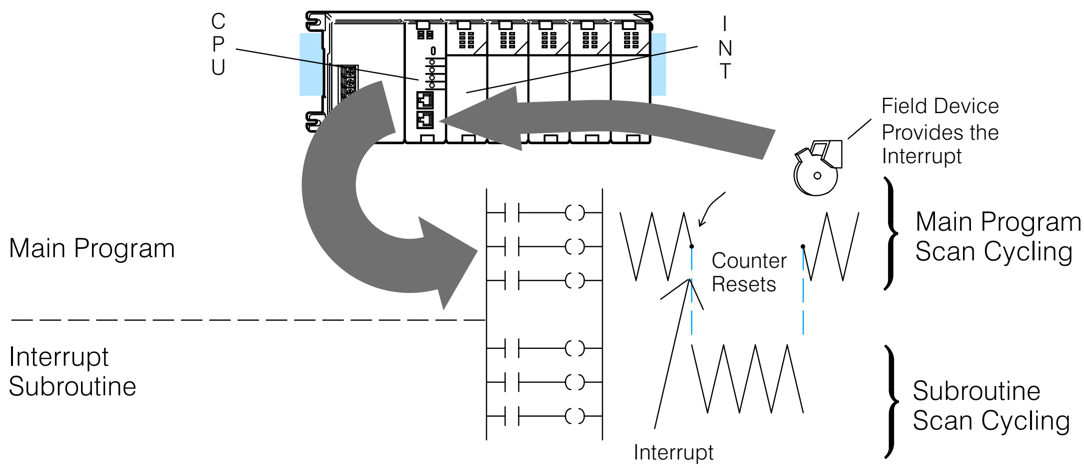
Note: If zero is put in V-memory as the filter time. The CPU will treat the configuration as having no filter.

Point 02 – Reset w/o an External Interrupt

When Mode 20 is selected, the CPU automatically writes 0007 to V7636. This value represents a reset at point 02 without an interrupt. If the reset is to trigger an interrupt, replace 0007 with 0107.

External Reset with Interrupt

An external reset with interrupt sets the counter to zero and allows temporary suspension of the normal scan process in the main program while an interrupt subroutine is executed. When the subroutine is complete, the CPU automatically resumes its routine scan cycle, starting where it was interrupted. The following diagram illustrates the process. For a complete discussion of interrupts, read Chapter 6.



Mode 20: UP/DOWN Counter

Custom Configurations

Up to this point, only Mode 20 default settings have been discussed. The default settings will be suitable for many applications, they will not require custom configuring. However, for those applications needing the defaults changed so the D2–CTRINT will work for the applications, use the following table which contains the options available.

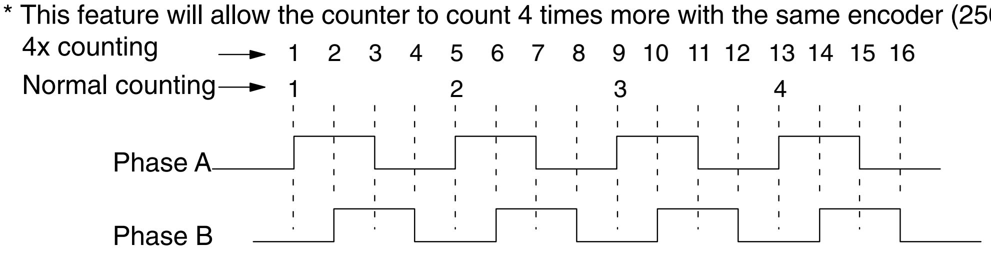
Mode 20 Custom Configuring

Mode 20 Options

Point Number	V-Memory	Definition (One per point)	Hex Value
point 00	V7634	UP/DOWN Counter having Phase A (quadrature) or 1st Encoder (standard)	0002 (quadrature, Absolute) default
			0102 (quadrature,Incremental)
			0202 (standard, Absolute)
			0302 (standard, Incremental)
			1002 (quadrature, Absolute) 4x counting*
			1102 (quadrature, Incremental) 4x counting*
point 01	V7635	Phase B or 2nd Encoder Input Depending on value in V7634	0000 default
point 02	V7636	Reset UP/DOWN Counter default	0007** (no interrupt) default no Z pulse or index marker recogonition
			0107 (interrupt) can recognize Z pulse or index marker
			0207 (interrupt) no Z pulse or index marker recognition
			0307 uses Z pulse recognition in the interrupt
		Pulse Catcher	0005
		Discrete Input	xx06 (xx=filter time=0 to 99ms)
point 03	V7637	Discrete Input	xx06 (xx=filter time=0 to 99ms)
		Pulse Catcher	0005
point 04	Not Used	Pulse Output (CCW)	Not Used

Note: The lower byte of V7633 is set to 20.

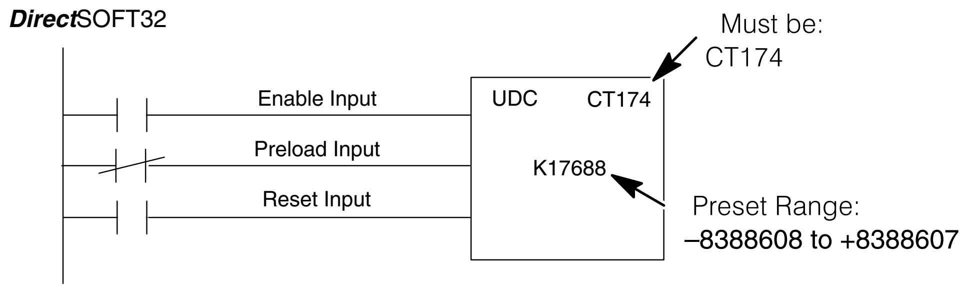
* This feature will allow the counter to count 4 times more with the same encoder (250–1/260 only).



** In a high speed application using a high resolution encoder, with the CPU programmed with presets that span the resolution of the encoder, you **may lose** pulses in the higher range of presets.
When using constants **K7** or **K107** in V7636 or V7637, the counter module will read the preset V–memory each time the counter is reset or at the index marker location.
When using **K207** or **K307**, the counter module reads the preset V–memory only at power up, or when a CPU mode change occurs (i.e. PROGRAM to RUN transition).

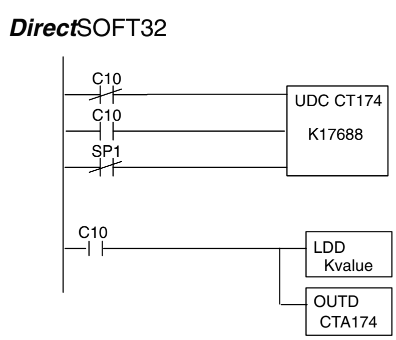
Writing the Control Program for the UP/DOWN Counter

Once the UP/DOWN Counter has been configured, the control program can be written. Writing the RLL program for the high speed counter is much the same as for a regular counter. The embedded high speed counters which are activated through the D2–CTRINT module, have three inputs. The first input (Enable) allows counting when active. The middle input (Preload) allows you to change the current count. The bottom input is to reset the counter. The preload input must be off while the counter is counting.



NOTE: To enter a negative number an 8 is placed in the most significant digit. For example: 80000570 entered in the preset gives a preset value of –570.

The mnemonic for the counter is UDC. It is found in the ***Direct***SOFT32 instruction browser that pulls down using the hotkey F7 while in the Edit Mode. After selecting the UDC, a box appears asking for the counter address and preset value. The counter address in the above example is CT174. The counter address for Mode 20 is always 174. The preset value of 17688 has been used for this example. This is the number of pulses to be received before the output of the counter goes high. Any value between –8,388,608 and +8,388,607 can be programmed for the preset. After entering the counter address and preset, enter the contact addresses for the contacts which are automatically drawn in the RLL program.

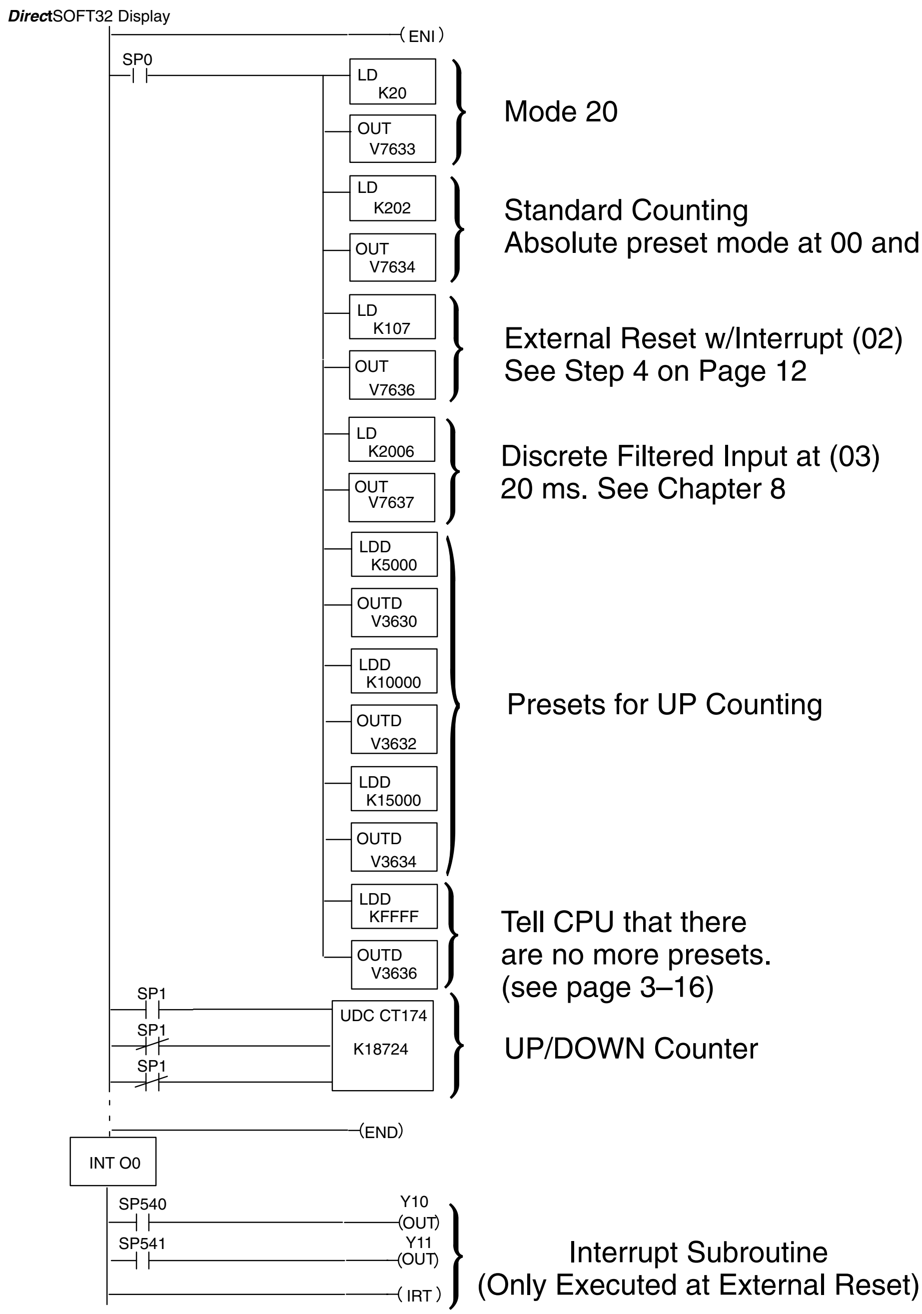


C10 is shown normally closed. When pulses are received at point 00, the current value in CTA174 will increment. When pulses are received at point 01, the current value will decrement. When C10 energizes, CTA174 stops counting and Kvalue is loaded for a new preload value. When an input is received at point 02, the counter will reset.

When the Enable input is energized, the high speed counter will respond to pulses at point 00 and increment the counter. When pulses are received at point 01, the counter will decrement. The reset input behaves in a logical OR fashion with the physical reset input point 02. The high speed counter can receive a reset from either the reset contact in the RLL or the external reset point 02 if it has been configured as an external input.

Example 1: UP/DOWN Counting with an Interrupt

Below is an example of how UP/DOWN counting with an interrupt can be programmed.



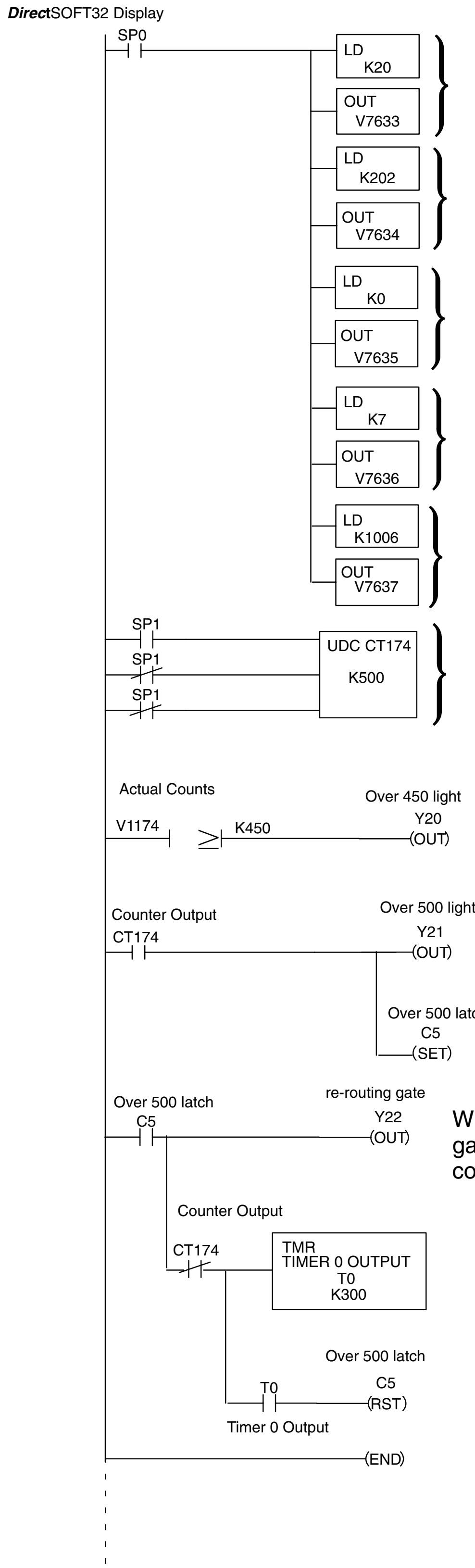
The load accumulator instructions have set up the V-memory as required, i.e. 20 in V7633 for the mode and 0202 in V7634 to designate a standard UP/DOWN counter with the Absolute preset mode. By placing 0107 in V7636, an external reset for counter 174 is selected and and it will execute interrupt 0 on the rising edge of the reset. Presets for UP/DOWN Counting have been stored in memory locations V3630 through V3635. The next even-numbered memory location following this has FFFF to indicate there are no more presets.

Example 2: An UP/DOWN Counter with Standard Inputs

In this example, assume there is a conveyor belt A that transports bottles to be inspected. During the course of the process, one sensor is keeping track of the bottles that are going onto belt A for inspection, and another sensor is keeping track of how many bottles are being removed to the finished product line.

When a quantity of 500 bottles has been reached in the process, an OVER 500 light turns on and a re-routing gate is activated to channel the incoming bottles to conveyor belt B. The re-routing gate will stay activated for 30 seconds after the conveyor belt A contains less than 500 bottles.

The program on the following page shows how the RLL program might be written for the process. Note the use of V1174. This memory location stores the current count for CT174 which is used with the D2-CTRINT.



Mode 20 (UP/DOWN counter)

Standard Counting
Absolute preset mode at 00 and 01

Must be zero with mode 20

External Reset without Interrupt (02)
See Page 4–7

Discrete Filtered Input at (03)
10 ms. See Chapter 8

UP/DOWN Counter
Only 1 counter is used with mode 20. The actual count (32-bit) is stored in V1175/V1174. When pulses are received at point 00, the value in V1175/V1174 will increment. When pulses are received at point 01, the value in V1175/V1174 will decrement.

When the pulse count reaches and exceeds 450, the “over 450” light (Y20) will turn on.

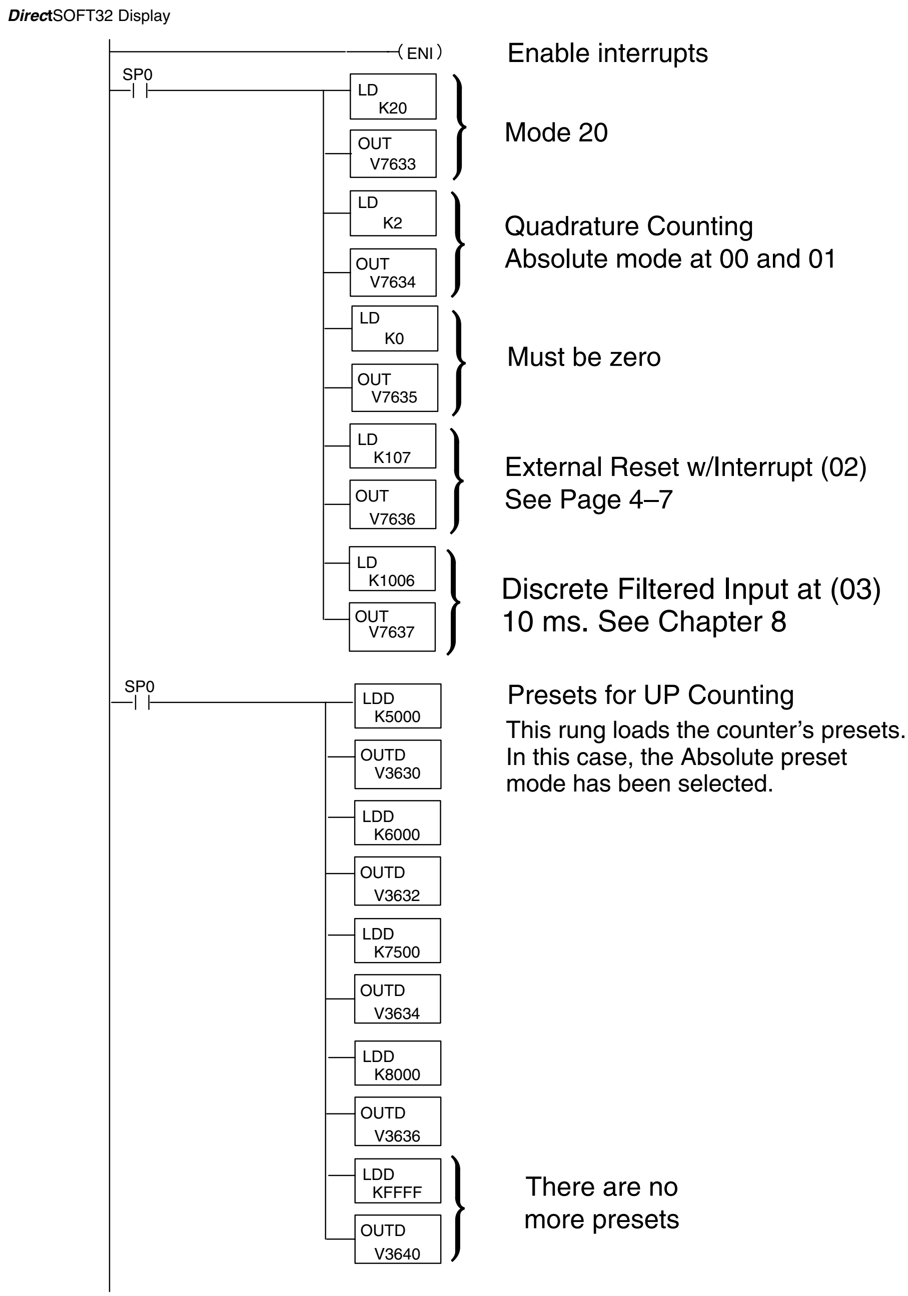
When the pulse count reaches and exceeds the preset value of 500, the output of the counter (CT174) goes high and turns on the “over 500” light (Y21) and latches C5.

When the count is 500 or over, the re-routing gate (Y22) turns on and will stay on until 30 seconds after the count falls below 500.

Example 3: Quadrature Counting

In this example, a wooden work piece is being drilled with three (3) holes. The holes are injected with glue for dowels to be inserted at another workstation. A quadrature encoder is connected to a positioning table which is moving a drill press horizontally over the work piece. The positioning table will stop and the drill press will lower to drill a hole in the exact location. After the three (3) holes are drilled in the work piece, the positioning table reverses direction and injects glue into the same holes.

The following program shows how this is done:



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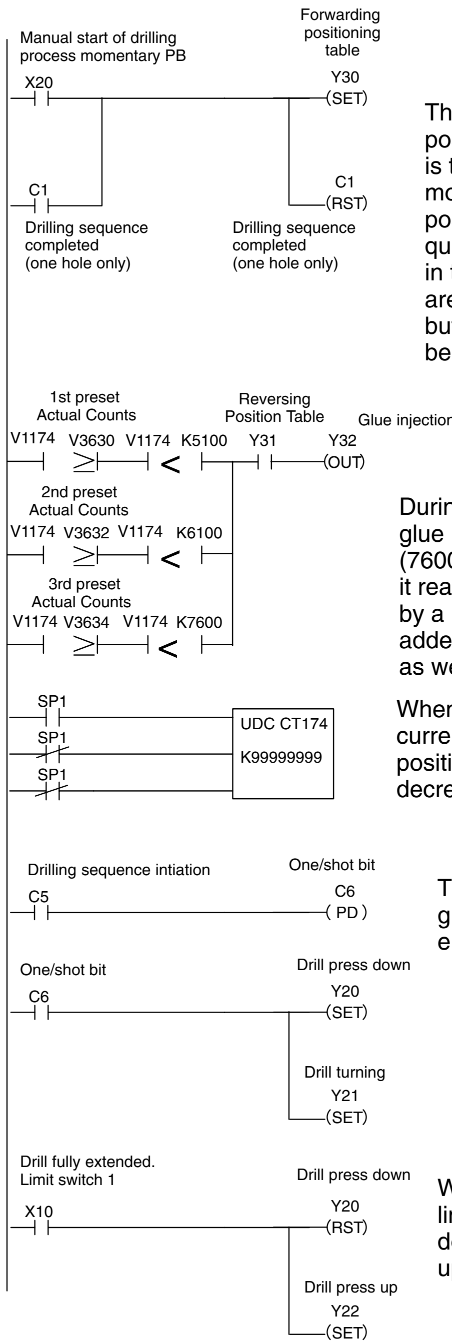
*Direct*SOFT32 Display



The operator starts the drilling by moving the positioning table forward. A quadrature encoder is transmitting the pulses to the D2-CTRINT module. After 5000 pulses are counted, the positioning table is stopped and the drilling sequence is started. Two more holes are needed in this work piece so the positioning and drilling are repeated twice automatically. (Stop and jog buttons are left out here for simplicity but should be incorporated in your logic.).

During the reversing of the positioning table, the glue injection is turned on between pulse counts (7600–7499),(6100–5999),(5100–4999) before it reaches its home position and is reset to zero by a limit switch (X2). NOTE: Presets can be added to trigger outputs when counting DOWN as well as counting UP.

When the positioning table moves forward, the current value in UDC174 increments. When the positioning table moves backward, the value decrements.

This rung initiates the drilling portion of our program. When C5 goes high the drill press is lowered and the drill bit starts to turn.

When the drill has reached the proper depth, limit switch 1 (X10) is turned on and stops the downward motion. This, in turn, raises the press up with the drill bit still turning.

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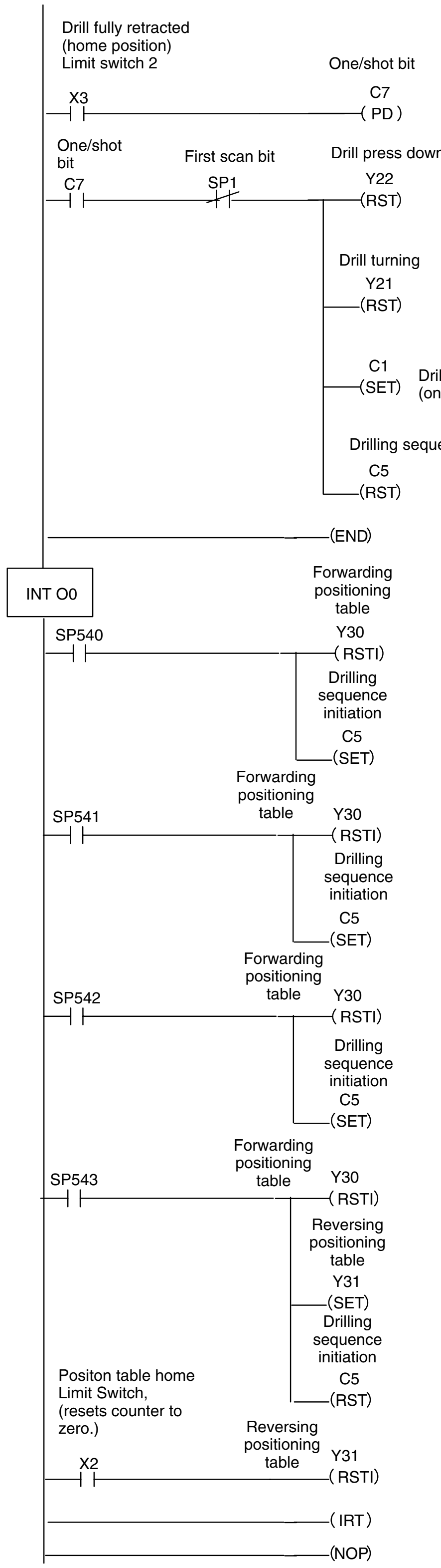
DirectSOFT32 Display



When X3 goes HIGH, the press has retracted to its home position and the drill bit stops turning. A one/shot (PD) is used to allow the cycle to be repeated because X3 stays HIGH until the press is lowered. (A first scan bit is used here to prevent the positioning table from turning on at power up).

When the pulse count reaches the first preset of 5000, the position table is stopped immediately and the drilling program logic is initiated.

When the pulse count reaches the second preset of 6000, the position table is stopped immediately and the drilling program logic is initiated.

When the pulse count reaches the third preset of 7500, the position table is stopped immediately and the drilling program logic is initiated.

When the pulse count reaches the fourth preset of 8000, the position table is stopped immediately and the reversing of the positioning table begins for the glue injection.

X2 (point 02) resets the counter and initiates the interrupt to reset (Y31).

Troubleshooting

What Can Go Wrong?

After completing the configuration of the UP/DOWN counter for Mode 20, the counter should work. If there is a problem with the counter operation, the information below and on the following pages may provide some assistance in handling any problems if they should occur. ***Experience has shown that most problems occur because of improper configuration. Always re-check your CPU setup before anything else.***

For verifying types of inputs (or outputs) besides those related to UP/DOWN counting, see the Chapters in this manual covering the specific function. Listed below are some things that could possibly go wrong with the UP/DOWN counter inputs:

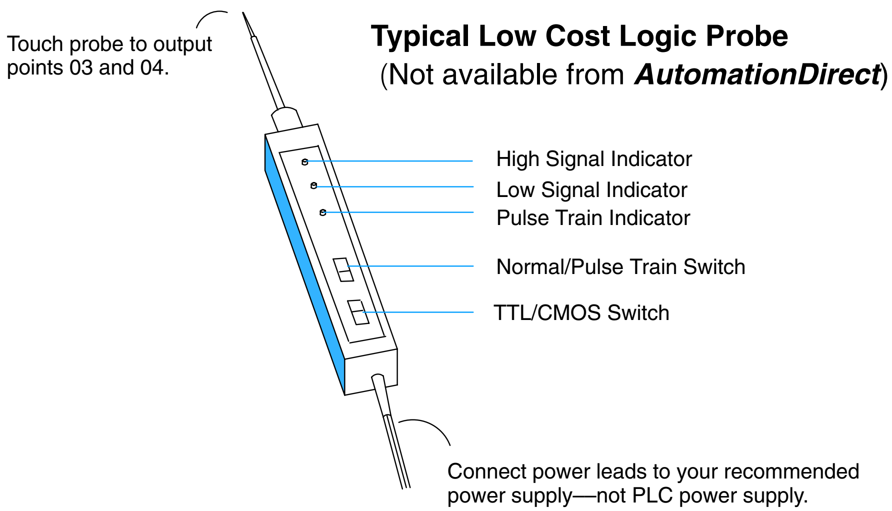
1. The counter is not counting UP or DOWN when configured for standard UP/DOWN counting.
2. When configured for standard UP/DOWN counting, the UP counter seems to be working, but there is no DOWN counting.
3. The status indicator LED is not lighting for the input point where the UP/DOWN counter is wired (i.e. points 00 and 01).
4. The counter does not appear to be counting synchronously with the input device's transitional states.
5. The counter is not resetting itself after it "counts out".
6. The counter is not jumping into its subroutine as expected when it reaches a preset condition.
7. The counter is counting properly and executing the interrupt properly, but does not continue counting after the interrupt subroutine has been completed.

Counter Doesn't Count

You should be able to see counting taking place in the counter block while observing it in the monitor mode with ***Direct***SOFT32. If this is not happening:

1. The CPU may be setup improperly. Check the RLL.
2. The field device may be defective.
3. The field device may be O.K., but it is too fast for the counter.
4. The wiring may be defective.
5. The input voltage may not be within specifications.
6. The configuration may be improperly setup.
7. The D2–CTRINT module is defective.

Defective Field Device - If a field device is suspected to be faulty, verify its proper operation first. Examine the characteristics of the pulses being received with an oscilloscope, test equipment type digital counter or an inexpensive logic probe which has a pulse train input capability.



A rotary encoder could also be operating improperly because of a poor coupling between the encoder and the shaft of the motor. Check to make sure the coupling is not defective. Check the specs on the field device. Be certain that it's output signal matches up with the specifications of the D2–CTRINT module.

Too fast – The pulse rate cannot exceed 5 kHz. If this is suspect, try to slow down the pulse rate to see if the problem is solved. The pulse width may also be too narrow. The pulse must remain high for at least 100ms in order for the module to detect it.

Wiring - Simple as this might seem, quite often poor wiring is the cause of many problems. Make sure there is a complete electrical loop between the device and the input module. Along with visual inspection, use a voltmeter to check this out.

Input Voltage - If the input device is producing a signal which is less than 12 volts, the counter will either not function properly or function improperly. Use a field device with the proper signal level if necessary.

Improper Configuration - The module may be looking for a counter which doesn't exist. Check the RLL program and be sure that the counter is addressed properly. Be certain that the inputs to the counter are properly configured. Is the counter enabled? This function is not available with the DL230.

LED's Do Not Light

Make sure the PWR or BAT LED's are not lit on the CPU module. If either the battery power or the external power indicators are not illuminated, there is either a defective power supply, the batteries are worn out or there is no power to the PLC.

Check to be certain that the status indicators are blinking as pulse signals are received at the proper input point on the module (i.e. 0 or 1). Check the field device to make sure it is operating. Use an oscilloscope or digital counter to verify the presence of a pulse train at the input point(s)) or use the Change Value feature in ***Direct***SOFT32 to force the input point ON. Refer to the ***Direct***SOFT32 **Software Programmers Manual** to use this feature. If after forcing the input ON, and the appropriate LED does not light, the module is defective..

WARNING: Take all necessary precautions to protect personnel and equipment when forcing inputs and outputs, since the equipment on the output side of the system may be energized.

Non–Synchronous Pulsing

If the counter is subject of counting faster than the field device is sending pulses, then the interface may be experiencing noise. Try connecting a shielded wire between the field device and the module input. The wire should be shielded at one end only-- normally the encoder side. If the PLC is interfaced to a rotary shaft encoder, a loose coupling could also be causing the problem. Check the coupling.

No Reset

If a reset is not present when expected, check the configuration. Is the proper value for a reset being used? Is the module looking for an external reset? If so, is the field device supplying the reset signal (which should be connected to either points 02) operating properly. Manually operate the reset device.

Not Jumping to Interrupt

Is the interrupt subroutine labeled properly? The interrupt subroutine must be labeled Octal 0. Is there supposed to be an external interrupt, but the external device is not sending the signal? Does the external interrupt device meet the input criteria? Check all of these possibilities.

Not Returning from Interrupt

Does the interrupt subroutine end with an Interrupt Return instruction in the RLL program? Is there an endless loop inside the subroutine? Is there a conditional return and the condition has not been met?

Rotary Encoders

Rotary encoders can be classified both in terms of how they are coupled to the rotating device for which they are providing information, and how they provide positional information. The rotary encoder can be mechanically coupled to the motor shaft, or it can be optically coupled internally to the encoder.