Sommario

THE COUNTER3 DEVICE

1. Introduction

The COUNTER3 device is used to acquire information from a two-way counter. Its main characteristics:

- conversion of pulses to selected unit measures
- position updating with recovery of unit measure fractions
- position capturing on activation of an interrupt digital input
- comparison between measured position and an activation threshold of digital outputs.

1.1 Declaring the device

To use the device it has to be declared in the INTDEVICE section of the configuration unit.

```
INTDEVICE
<device name> COUNTER3 <TCamp> <ICont> <IdxA> <Out1> <Out2>
```

Where:

Field name	Description	Example	Notes
<device name>	Name assigned to the device.	Count	-
COUNTER3	Keyword identifying the two-way count device	-	-
<TCamp>	Device sampling time (1-255 ms)	4	-
<ICont>	Counter address in card	3.CNT01	Enter X.X to ignore
<IdxA>	Hardware interrupt line number to capture the count	1	Enter X to ignore
<Out1>	Comparator output 1 address	3.OUT01	Enter X.X to ignore
<Out2>	Comparator output 2 address	3.OUT02	Enter X.X to ignore

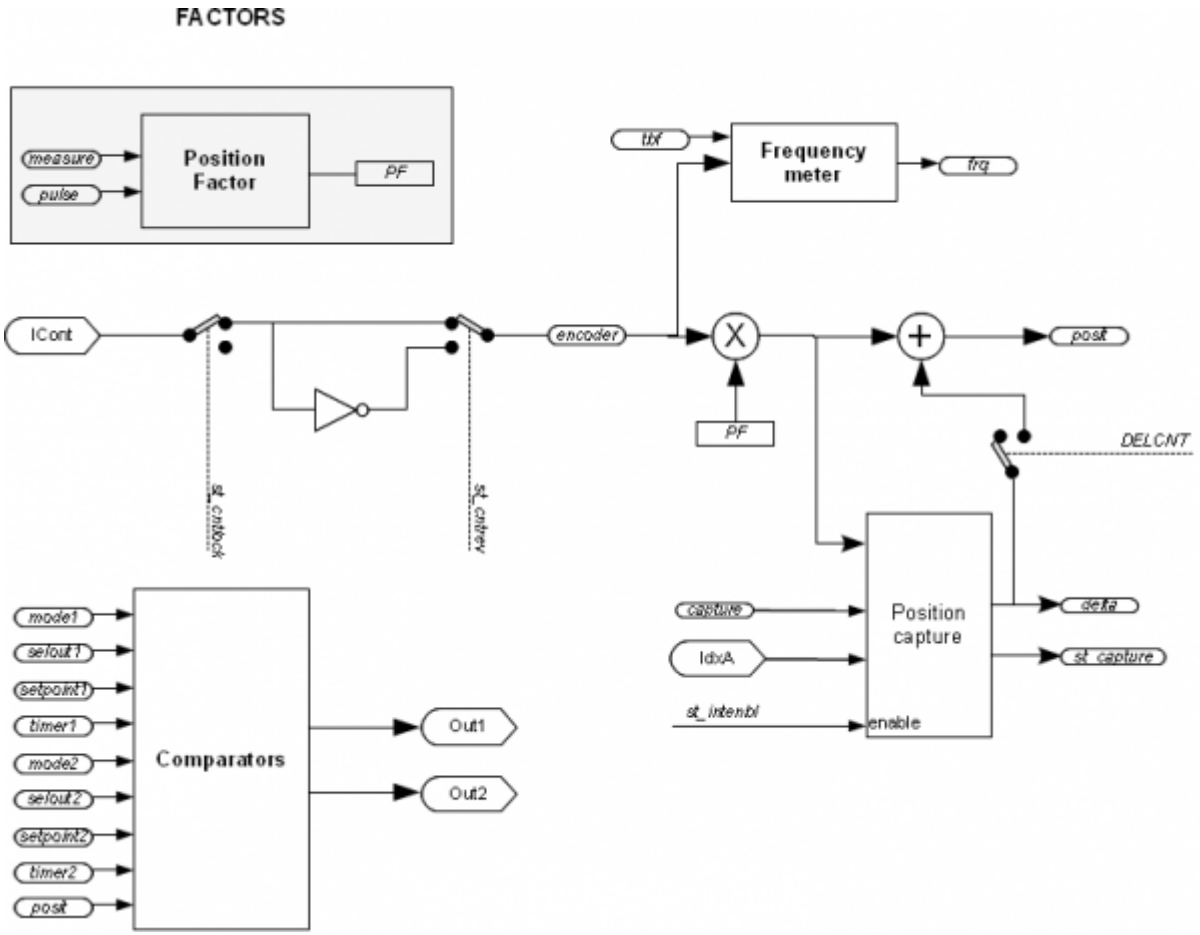
Example:

```
INTDEVICE
Count  COUNTER3  2  2.CNT02  3    2.OUT01  2.OUT02
```

All fields in the declaration are mandatory and must be on the same line. Set X.X or X if a resource is not available or not used. If a resource is disabled all the functionalities related to the device are disabled.

1.2 Execution Description

A block chart of the device:



1.2.0.1 Factors

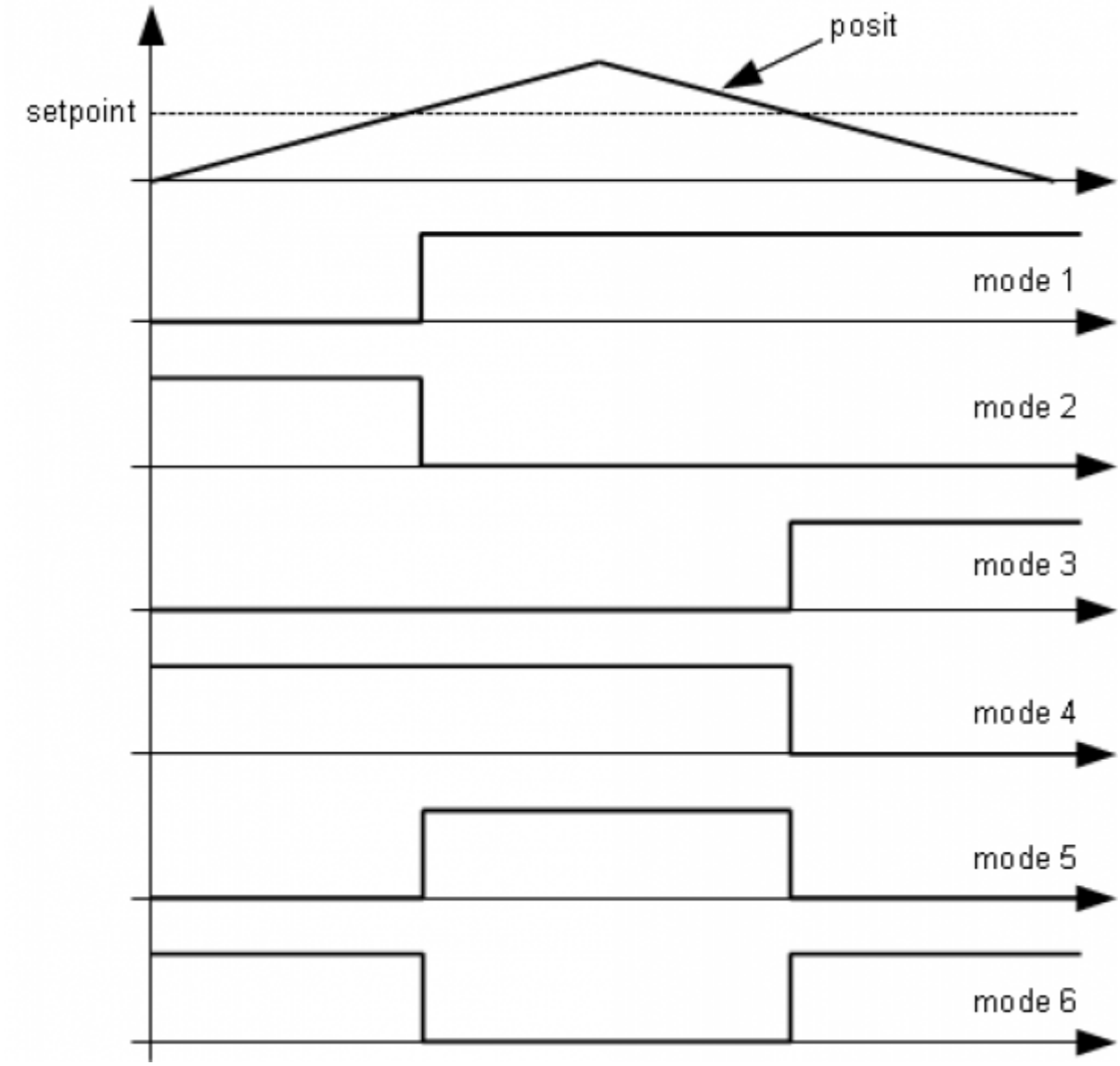
The “Factors” block calculates the conversion factors for position and speed. The “position factor” (PF) is a position conversion coefficient expressed in the unit measure of the of the transducer in the position unit measure (Um), and vice versa. Usually the position unit measure is, for example, metres or millimetres or centimetres, while the transducer unit measure, as an encoder, is always pulses. The parameters used to calculate the position factor are *pulse* and *measure* and it is calculated as a ratio between the two.

1.2.0.2 Acquisition of the actual position on an interrupt digital input

The *INTENBL* and *INTDSBL* commands enable (*st_intenbl*=1) and disable (*st_intenbl*=0) the interrupt line connected to the zero pulse of the transducer or another sensor. The value of the *capture* parameter defines which pulse front the instant count is frozen and the count captured is introduced in the *delta* parameter. The *st_capture* status signals that the capture is made.

1.2.0.3 Comparators

The device also provides two comparators that can be used to compare the actual value of the *posit* parameter with two values (*setpoint1* and *setpoint2*) set by the programming. As a result the comparators act on two digital outputs, activating or disactivating them when the set thresholds are met according to various conditions. There are two outputs available (as seen in the the device declaration and block chart) and there is a good level of personalisation: each comparator can select which output to command and based on which conditions. The *mode1* parameters (controlling comparator 1) selects the activation or disattivazione policy of the corresponding output according to given rules.



The figure shows examples of the different execution modes:

- mode 0: the output stays in its status
- mode 1: the output is activated when the position in pulse fronts is greater than the setpoint;
- mode 2: the output is disactivated when the position in pulse fronts is greater than the setpoint;
- mode 3: the output is activated when the position in pulse fronts is less than the setpoint;
- mode 4: the output is disactivated when the position in pulse fronts is less than the setpoint;
- mode 5: the output is activated when the position in pulse fronts is greater than the setpoint and is disactivated when the position in pulse fronts is less than the setpoint;
- mode 6: the output is disactivated when the position in pulse fronts is greater than the setpoint and is activated when the position in pulse fronts is less than the setpoint.

1.2.0.4 Delta Actual position

The device always gives the absolute position of the axis. The count change can also be performed by directly writing the new value of the *posit* parameter.
If 100 unit measures are subtracted from the count:

```
Count.posit = Count.posit - 100
```

An error is introduced because it sets the position □*posit* = -100□, when the axis may have an intermediary position between one unit measure and the next (e.g. 100.3). This fraction (0.3) is lost and if repeated can cause a build up of a significant error. For this reason there is the DELCNT command that can change the posit by a value set by the *delta* parameter.
For instance, if *pulse* and *measure* are configured to express the position in tenths of a degree and *posit* expresses the angular position. For this to always fall between zero and 360 degrees, the following code must be added:

```
IF Count.posit GE 3600
  Count.delcnt = -3600
  Count.DELCNT
ENDIF
```

For the command execution conditions see its specific description. Execution of the DELCNT command is ensured even if a unit measure cannot be expressed as a finite number of pulse fronts. For instance with parameters measure = 1000 and pulse = 1024, the value 3600 of the previous example corresponds to 3686.4 pulses. A complex internal algorhythm allows the device to consider the decimal part of this value and by internal accumulators, it becomes part of the information used to change the posit value.
Example:
If *pulse* = 10, *measure* = 1, the axis position reading is 2 and it is found at point A.

To add two unit measures to the *posit* position. The instructions :

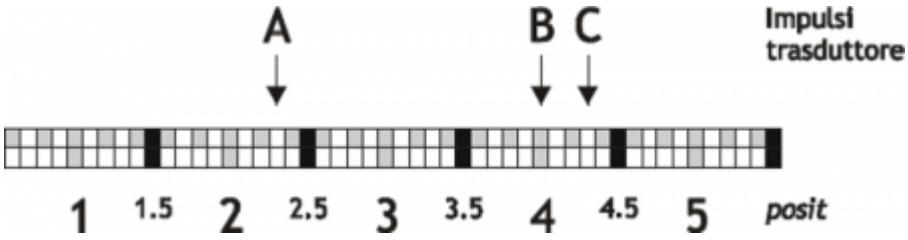
```
Count.posit = Count.posit + 2
```

take the axis to the new position B. The instructions:

```
Count.delta = 2
Count.DELCNT Asse
```

take the axis to position C.

If *posit* is modified directly without using the *DELCNT* command (as in the first example) an error is introduced.



To send a sequence of *DELCNT* commands, it is best to calculate the size of the addition and only send the command once. If this is not possible great care must be taken to avoid sending a sequence of commands not separated by a read instruction on the device parameter.
Example:

```
Count.delta = 3
Count.DELCNT
WAIT Count.delta
Count.delta = 40
Count.DELCNT
```

1.3 Errors management

The presence of an error in device is reported in the state *st_error*.
When *st_error* is equal to 1, we find in the variable *errcode* the type of error intervened (see table) and in the variable *errvalue* an indication of the cause of the error.
If the device is in error, to resume production you need to erase the state through the command *RSERR*

1.4 Warnings management

The presence of a warning in device is reported in the state *st_warning*.
When *st_warning* is equal to 1, we find in the variable *wrncode* the type of warning intervened (see table) and in the variable *wrnvalue* an indication of the cause of the warning.

Code	Priority	Description
1	0	Command not executed

To clear the status *st_warning* we must send the command *RSWRN*.

1.5 List of Parameters

measure

Short description	Reference measurement for the calculation of the conversion factor between pulse fronts and unit measures
Dimension	Long
Default value	Retentive
Access type	Read - Write
Unit measure	Um

Valid range	1-999999
Parameter ID	-
Write conditions	-

Description:

Indication of the distance, in unit measures, travelled by the axis to obtain the pulse fronts set in the pulse parameter. This parameter is used to calculate the conversion factor between pulse fronts and unit measures.
*posit = encoder * measure / pulse*
The *measure / pulse* ratio must be between 0.00935 and 1.

---

pulse

Short description	Number of pulse fronts for the calculation of the conversion facter between pulse fronts and unit measures
Dimension	Long
Default value	Retentive
Access type	Read - Write
Unit measure	-
Valid range	1-999999
Parameter ID	-
Write conditions	-

Description:

Indication of the number of pulse fronts that the two-way transducer will generate to obtain a movement equal to measure. This parameter is used to calculate the conversion factor between pulse fronts and unit measures.
*posit = encoder * measure / pulse*
The *measure / pulse* ratio must be between 0.00935 and 1.

---

posit

Short description	Actual position in unit measures
Dimension	Long
Default value	Retentive
Access type	Read - Write
Unit measure	Um
Valid range	-
Parameter ID	-
Write conditions	-

Description:

The actual position value of the axis in unit measures.
*posit = encoder * measure / pulse*.

---

encoder

Short description	Actual position in pulse fronts
Dimension	Long
Default value	Retentive
Access type	Read - Write
Unit measure	Pulse fronts
Valid range	-
Parameter ID	-
Write conditions	-

Description:

The actual position expressed in pulse fronts.

delta

Short description	Variation of instant position for using the DELCNT command
Dimension	Long
Default value	Retentive
Access type	Read - Write
Unit measure	Um
Valid range	-999999-999999
Parameter ID	-
Write conditions	-

Description:

The value added to the instant position when a DELCNT command is sent. Moreover the position in the *delta* parameter is memorised when using the acquisition on activation of an interrupt digital input.

---

axetype

Short description	Type of axis
Dimension	Flag
Default value	Retentive
Access type	Read - Write
Unit measure	-
Valid range	-999999-999999
Parameter ID	-
Write conditions	-

Description:

Selection of the type of axis being commanded:

- 0: linear axis
- 1: circular axis (angular). The count starts again from zero after reading the *measure* value.

---

capture

Short description	Position capture mode on activation of an interrupt digital input
Dimension	Byte
Default value	Retentive
Access type	Read - Write
Unit measure	-
Valid range	0-2
Parameter ID	-
Write conditions	-

Description:

The parameter defines the capture mode for the position in pulse fronts on activation of an interrupt digital input:

- 0: disabled,
- 1: One-shot on down front. The instant position is captured in pulse fronts on the first down front of the interrup digital input signal after activation of *st_intenbl*;
- 2: One-shot on up front . The instant position is captured in pulse fronts on the first up front of the interrupt digital input signal after activation of *st_intenbl*.

---

tbf

Short description	Frequency meter sampling time
Dimension	Byte
Default value	Retentive
Access type	Read - Write
Unit measure	-
Valid range	0-5
Parameter ID	-
Write conditions	-

Description:

Definition of the frequency meter sampling time:

- 0: 240 ms,
- 1: 480 ms,
- 2: 24 ms,
- 3: 120 ms,
- 4: 960 ms,
- 5: 1200 ms.

The device, for calculation of the signal frequency input at the two-way counter (frq parameter), counts the number of pulses received in a time period defined by the *tbf* parameter and calculates an average value. The lower the sampling time, the faster the update of the *frq* parameter, however take care at low frequencies because the sampling time may not be long enough to sample.

---

frq

Short description	Input signal frequency
Dimension	Long
Default value	0
Access type	Read
Unit measure	Hz
Valid range	-
Parameter ID	-
Write conditions	-

Description:

It's the value of the two-way count input signal frequency. The updates rate is dependent on the sampling time selected by the *tbf* parameter.

---

mode1

Short description	Output command mode indicated in selout1 by the comparator
Dimension	Byte
Default value	Retentive
Access type	Read - Write
Unit measure	-
Valid range	0-6
Parameter ID	-
Write conditions	-

Description:

This parameter defines the activation and disattivazione rules for the output indicated in the *selout1* parameter by the comparator.

---

selout1

Short description	Output commanded by comparator 1

Dimension	Byte
Default value	Retentive
Access type	Read - Write
Unit measure	-
Valid range	0-1
Parameter ID	-
Write conditions	-

Description:

Indication of the output is commanded by comparator 1:

- 0: Out1,
- 1: Out2.

---

setpoint1

Short description	Comparation threshold for comparator 1
Dimension	Long
Default value	Retentive
Access type	Read - Write
Unit measure	Um
Valid range	-999999-999999
Parameter ID	-
Write conditions	-

Description:

Definition of the threshold setpoint for comparing with the instant position value in pulse fronts. The modified output is indicated by the *selout1* parameter.

---

timer1

Short description	Activation delay time of selout1 output
Dimension	Word
Default value	Retentive
Access type	Read - Write
Unit measure	ms
Valid range	-999999-999999
Parameter ID	-
Write conditions	-

Description:

Definition for the output indicated in *selout1*, of a time period between the event commanding the actual switching (i.e. a delay on the digital output activation or disactivation is introduced.)

---

mode2

Short description	Output command mode indicated in selout1 by the comparator
Dimension	Byte
Default value	Retentive
Access type	Read - Write
Unit measure	-
Valid range	0-6
Parameter ID	-
Write conditions	-

Description:

This parameter defines the activation and disactivation rules for the output indicated in the *selout2* parameter by the

comparator.

---

selout2

Short description	Output commanded by comparator 1
Dimension	Byte
Default value	Retentive
Access type	Read - Write
Unit measure	-
Valid range	0-1
Parameter ID	-
Write conditions	-

Description:

Indication of which output is commanded by comparator 2:

- 0: Out1,
- 1: Out2.

---

setpoint2

Short description	Comparation threshold for comparator 1
Dimension	Long
Default value	Retentive
Access type	Read - Write
Unit measure	Um
Valid range	-999999-999999
Parameter ID	-
Write conditions	-

Description:

Definition of the setpoint (i.e. threshold) where the instant position is compared in pulse fronts. The output consequently modified is indicated by the *selout2* parameter.

---

timer2

Short description	Activation delay time for selout1 output
Dimension	Word
Default value	Retentive
Access type	Read - Write
Unit measure	ms
Valid range	-999999-999999
Parameter ID	-
Write conditions	-

Description:

The output indicated by *selout2*, this parameter defines a delay time between the event that commands the output switching and the actual switching (i.e. a delay on the digital output activation or disactivation)

---

errcode

Short description	error ID code
Dimension	Byte
Default value	0
Access type	Read

Unit measure	-
Valid range	0-100
Parameter ID	-
Write conditions	-

Description:

Indication of the type of error tripped in the system. When *st_error = 1* is found in the errcode variable, the type of error and the errvalue variable gives an indication on the cause of error. If an error trips in the device, to restore operation bisogna cancellare the st_error status must be eliminated by the *RSERR* command.
This device does not create an error code.)

---

errvalue

Short description	Cause of error ID code
Dimension	Byte
Default value	0
Access type	Read
Unit measure	-
Valid range	0-100
Parameter ID	-
Write conditions	-

Description:

Indication of the cause of an error tripped in the system. The code is only valid if *st_error* = 1)

---

wrncode

Short description	Warning ID code
Dimension	Byte
Default value	0
Access type	Read
Unit measure	-
Valid range	0-100
Parameter ID	-
Write conditions	-

Description:

Indication of the type of warning tripped in the system. The *st_warning* status indicates a non-critical event that nevertheless assures device execution. When *st_warning* is 1, the *wrncode* variable will contain the type of warning (see table) and the *wrnvalue* variable will contain the cause of the warning. The *st_warning* status is reset by sending the *RSWRN* command.)

Code	Priority	Description
1	0	Command not executed

—-

wrnvalue

Short description	Cause of warning ID code
Dimension	Byte
Default value	0
Access type	Read
Unit measure	-
Valid range	0-100
Parameter ID	-
Write conditions	-

Description:

Indication of the cause of warning tripped in the system.)

1.6 Status List

st_cntlock

Short description	**Update position status disabled**
Default value	Retentive
Status ID	-

Description

Signal that the position update is blocked :

- 0: position update enabled
- 1: position update disabled

---

st_cntrev

Short description	**Invert position update status**
Default value	Retentive
Status ID	-

Description

Signal that the position update is inverted:

- 0: position update not inverted,
- 1: position update inverted

---

st_intenbl

Short description	**Interrupt digital input activation status**
Default value	0
Status ID	-

Description

Signal that the capture instant position is enabled on the interrupt digital input, which is activated by the *INTENBL* command and disactivated by the *INTDSBL* command or on the *st_capture* rising front.

---

st_capture

Short description	**Capture instant position activation**
Default value	0
Status ID	-

Description

The instant position capturing is activated, which is reset by the *RSCAPTURE* command.

---

st_int

Short description	**Interrupt digital input status**
Default value	0
Status ID	-

Description

Indication of the interrupt digital input status :

- 0: interrupt digital input disattivated
- 1: interrupt digital input activated

---

st_cmp1

Short description	**Comparator 1 status**
Default value	0
Status ID	-

Description

Activation signal for comparator 1:

- 0: comparator 1 disactivated
- 1: comparator 1 activated

---

st_cmp2

Short description	**Comparator 2 status**
Default value	0
Status ID	-

Description

Activation signal for comparator 2:

- 0: comparator 2 disactivated
- 1: comparator 2 activated

---

st_error

Short description	**Error present**
Default value	0
Status ID	-

Description

Indication of a device error status, to know the type of error refer to the *errcode* and *errvalue* variables:

- 0: error not present
- 1: error present

---

st_warning

Short description	**Warning present**
Default value	0
Status ID	-

Description

Indication of a warning status of the device, to know the type of warning refer to the *wrncode* and *wrnalue* variables:

- 0: warning not present
- 1: warning present

1.7 List of Commands

The commands provided to manage the device are listed below, ordered in decreasing priority. There are two ways to execute a command: * By the Qview watches panels * By a QCL instruction

In the second case the QCL program execution is blocked until the end of the command, which lasts between 0 and 2 sampling times.

CNTLOCK

Short description	**Disables update of the actual position**
Condition	-
Default value	
Command ID	-

Description

Disables update of the actual position. In this condition any axis movement is not detected

---

CNTUNLOCK

Short description	**Enables update of the actual position**
Condition	-
Default value	
Command ID	-

Description

Enables update of the actual position

CNTREV

Short description	**Inversion of position update**
Condition	-
Default value	
Command ID	-

Description

It can invert the sign of the position update; the *st_cntrev* status is set to 1.

CNTDIR

Short description	**Position update not inverted**
Condition	-
Default value	
Command ID	-

Description

Disables an inversion of the position update; the *st_cntrev* status is set to zero.

INTENBL

Short description	**Enables the actual position capture on activation of the interrupt digital input**
Condition	capture>0

Default value	
Command ID	-

Description

Activates the actual position capture on activation of the interrupt digital input dedicata, the value is memorised in the delta parameter. The *st_intenbl* status is active

INTDSBL

Short description	**Disables the instant position capture on activation of the interrupt digital input**
Condition	-
Default value	
Command ID	-

Description

Disactivates the instant position capture on activation of the dedicated interrupt digital input. The *st_intenbl* status is disattivated

---

RSCAPTURE

Short description	**Deactivation of the capture status**
Condition	-
Default value	
Command ID	-

Description

Deactivates the *st_capture* capture status

DELCNT

Short description	**Modify *posit* command by a value equal to *delta***
Condition	st_intenbl=0
Default value	
Command ID	-

Description

The axis position is modified by agebraic addition of the value specified in the *delta* variable

---

SETCMP1

Short description	**Activate comparation 1**
Condition	-
Default value	
Command ID	-

Description

Forced activation of the *st_cmp1* status

RESCMP1

Short description	**Reset comparation 1**
Condition	-
Default value	
Command ID	-

Description

Zero set *st_cmp1* status

SETCMP2

Short description	**Activate comparation 2**
Condition	-
Default value	
Command ID	-

Description

Forzed activation of the *st_cmp2* status

RESCMP2

Short description	**Reset comparation 2**
Condition	-
Default value	
Command ID	-

Description

Zero-set the *st_cmp2* status

RSERR

Short description	**Reset error status**
Condition	-
Default value	
Command ID	-

Description

Zero-set the *st_error* status

RSWRN

Short description	**Reset warning status**
Condition	-
Default value	
Command ID	-

Description

Zero-set the *st_warning* status

1.8 Limitations

If you change the parameters *measure* or *pulse* after sending the command *DELCNT*, the remains of the conversion of the delta space in pulses are reset.

1.9 Application example

This example can be compiled with QView 6.0 or higher.

1.9.1 Configuration unit

```
;*******************************************************************************
; COUNTER3 example
;*******************************************************************************

; Bus declaration
BUS
  1  1K31F    20
  2  .        .
  3  1MG8F    .
  4  .

; Input declaration
INPUT
  ifEnableZ     F     3.INP01        ;Zero pulse capture enabling
  ifEnableComp  F     3.INP03        ;Comparation enabling

; Output declaration
OUTPUT
  out201      F     3.OUT01        ;Comparation output #1
  out202      F     3.OUT02        ;Comparation output #2

; Device declaration
INTDEVICE
Count    COUNTER3   2       3.CNT01     1       3.OUT01  3.OUT02

END
```

1.9.2 COUNTER3 management unit

```
SYSTEM
  slPrsPos   L  IN               ;Quota di preset
  slSet1     L  IN               ;Setpoint 1
  slSet2     L  IN               ;Setpoint 2

GLOBAL
  gfApp01    F
  gfApp02    F

BEGIN
;-------------------------------------------------------------------------------
; Initialization
;-------------------------------------------------------------------------------
Count.measure = 1000              ;measure per round
Count.pulse = 1000                ;pulse per round

Count.capture = 1                 ;set capture on rise edge
IF slSet1 EQ 0
  slSet1 = 500                    ;Default value
ENDIF
IF slSet2 EQ 0
  slSet2 = 100                    ;Default value
ENDIF

MAIN:


  IF ifEnableZ                                ;If the input is ON
    Count.INTENBL                             ;Zero pulse enabling
  ELSE
    Count.INTDSBL                             ;Zero pulse disabling
  ENDIF

  IF Count.st_capture                         ;When the count has captured
    Count.delta = -(Count.delta - slPrsPos)   ;load delta
    Count.DELCNT                              ;Set the new position
    Count.RSCAPTURE                           ;Reset the capture
  ENDIF

  IF ifEnableComp                             ;When it is enabled
    IF NOT gfApp01
      Count.mode1 = 5                          ;Set Mode1 for comparation 1
      Count.selout1 = 0
      Count.setpoint1 = slSet1
      Count.timer1 = 0
      Count.mode2 = 6                          ;Set Mode2 for comparation 2
      Count.selout2 = 1
      Count.setpoint2 = slSet2
      Count.timer2 = 0
      gfApp01 = 1
      gfApp02 = 0
    ENDIF
  ELSE                                        ;When it is not enabled
    IF NOT gfApp02
      Count.mode1 = 0                          ;Comparation 1 disabled
      RESOUT out201                           ;Reset output
      Count.selout1 = 0
      Count.mode2 = 0                          ;Comparation 1 disabled
      RESOUT out202                           ;Reset output
      Count.selout2 = 1
      gfApp01 = 0
      gfApp02 = 1
    ENDIF
  ENDIF

  WAIT 1
  JUMP MAIN

END
```