Modicon Momentum

170 AEC 920 00

User Manual

(Original Document)

12/2018

33001466.09

www.schneider-electric.com

Schneider Electric

All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

Table of Contents

Safety Information

Important Information

NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER
DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

WARNING
WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

CAUTION
CAUTION indicates a hazardous situation which, if not avoided, **could result** in minor or moderate injury.

NOTICE
NOTICE is used to address practices not related to physical injury.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

BEFORE YOU BEGIN

Do not use this product on machinery lacking effective point-of-operation guarding. Lack of effective point-of-operation guarding on a machine can result in serious injury to the operator of that machine.

⚠ WARNING

UNGUARDED EQUIPMENT

- Do not use this software and related automation equipment on equipment which does not have point-of-operation protection.
- Do not reach into machinery during operation.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

This automation equipment and related software is used to control a variety of industrial processes. The type or model of automation equipment suitable for each application will vary depending on factors such as the control function required, degree of protection required, production methods, unusual conditions, government regulations, etc. In some applications, more than one processor may be required, as when backup redundancy is needed.

Only you, the user, machine builder or system integrator can be aware of all the conditions and factors present during setup, operation, and maintenance of the machine and, therefore, can determine the automation equipment and the related safeties and interlocks which can be properly used. When selecting automation and control equipment and related software for a particular application, you should refer to the applicable local and national standards and regulations. The National Safety Council's Accident Prevention Manual (nationally recognized in the United States of America) also provides much useful information.

In some applications, such as packaging machinery, additional operator protection such as point-of-operation guarding must be provided. This is necessary if the operator's hands and other parts of the body are free to enter the pinch points or other hazardous areas and serious injury can occur. Software products alone cannot protect an operator from injury. For this reason the software cannot be substituted for or take the place of point-of-operation protection.

Ensure that appropriate safeties and mechanical/electrical interlocks related to point-of-operation protection have been installed and are operational before placing the equipment into service. All interlocks and safeties related to point-of-operation protection must be coordinated with the related automation equipment and software programming.

NOTE: Coordination of safeties and mechanical/electrical interlocks for point-of-operation protection is outside the scope of the Function Block Library, System User Guide, or other implementation referenced in this documentation.

START-UP AND TEST

Before using electrical control and automation equipment for regular operation after installation, the system should be given a start-up test by qualified personnel to verify correct operation of the equipment. It is important that arrangements for such a check be made and that enough time is allowed to perform complete and satisfactory testing.

⚠ WARNING
EQUIPMENT OPERATION HAZARD ● Verify that all installation and set up procedures have been completed. ● Before operational tests are performed, remove all blocks or other temporary holding means used for shipment from all component devices. ● Remove tools, meters, and debris from equipment. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Follow all start-up tests recommended in the equipment documentation. Store all equipment documentation for future references.

Software testing must be done in both simulated and real environments.

Verify that the completed system is free from all short circuits and temporary grounds that are not installed according to local regulations (according to the National Electrical Code in the U.S.A, for instance). If high-potential voltage testing is necessary, follow recommendations in equipment documentation to prevent accidental equipment damage.

Before energizing equipment:
- Remove tools, meters, and debris from equipment.
- Close the equipment enclosure door.
- Remove all temporary grounds from incoming power lines.
- Perform all start-up tests recommended by the manufacturer.

OPERATION AND ADJUSTMENTS

The following precautions are from the NEMA Standards Publication ICS 7.1-1995 (English version prevails):

- Regardless of the care exercised in the design and manufacture of equipment or in the selection and ratings of components, there are hazards that can be encountered if such equipment is improperly operated.
- It is sometimes possible to misadjust the equipment and thus produce unsatisfactory or unsafe operation. Always use the manufacturer's instructions as a guide for functional adjustments. Personnel who have access to these adjustments should be familiar with the equipment manufacturer's instructions and the machinery used with the electrical equipment.
- Only those operational adjustments actually required by the operator should be accessible to the operator. Access to other controls should be restricted to prevent unauthorized changes in operating characteristics.

About the Book

At a Glance

Document Scope

This manual describes the structure and the configuration of the fast counter module AEC 920. The different operating modes are explained using the applications as examples.

Validity Note

This documentation is valid for EcoStruxure™ Control Expert 14.0 or later.

Product Related Information

⚠ WARNING
UNINTENDED EQUIPMENT OPERATION The application of this product requires expertise in the design and programming of control systems. Only persons with such expertise should be allowed to program, install, alter, and apply this product. Follow all local and national safety codes and standards. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Part I
Function Overview

Overview

This part of this manual provides a brief overview of the structure, application, and various operating modes of the 170 AEC 920 00 fast counter module.

What Is in This Part?

This part contains the following chapters:

Chapter 1
Introduction

Overview

This chapter contains a short overview of function mode and application range.

What Is in This Chapter?

This chapter contains the following topics:

Introduction

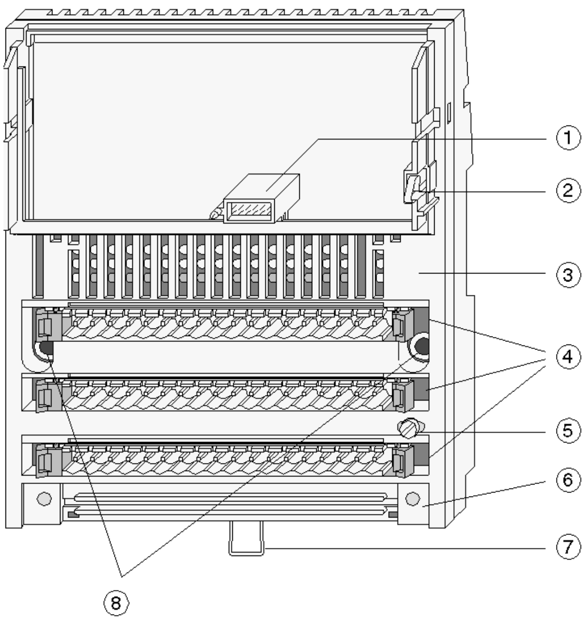
General Information about the 170 AEC 920 00 Counter

The 170 AEC 920 00 I/O unit is used for fast counting operations and conforms to the system properties of the Modicon Momentum family. With the addition of a bus or CPU adapter it forms an operating module.

In this book, the mode of operation of the 170 AEC 920 00 is described.

- introduction (current chapter)
- description of the operating modes *(see page 19)*
- hardware description of the 170 AEC 920 00 unit *(see page 43)*
- counter configuration *(see page 63)*
- status messages and numerical values *(see page 87)*
- DFB parameter settings *(see page 97)*

Module view



1 internal connector to the adapter
2 locking and grounding contact for the adapter
3 LED display field
4 sockets for the terminal plugs
5 grounding screw
6 installation point for busbar
7 locking catch for DIN rail
8 holes for wall mounting

Function Mode and Application Range

Use of the 170 AEC 920 00

The 170 AEC 920 00 I/O unit has two hardware counters with a maximum input frequency of 200 kHz.

They can be used for the following applications:
- event counts
- frequency measurements
- period measurements
- clock output (pulse generator)
- path evaluation using incremental encoders

The module can therefore be used to evaluate pulses and positions. To do this, one of 13 possible operating modes must be set depending on the application. See Operating Modes *(see page 20)*.

Encoders evaluate impulses or positions and send this information on to the I/O unit. The I/O unit's firmware interprets them, depending on the operating mode, as impulses, path increments, etc. and compares them continuously with preset values. It controls two hardware outputs per counter depending on the result of this comparison. These outputs can therefore used for pre-stop and limit switch outputs.

These operating modes often demand particular types of encoder (impulse encoders, absolute encoders, or incremental encoders). The encoder input signals are 5 volt signals; 24 volt signals are also acceptable in many applications.

For the control of counting and comparison functions, each of the two counters has three additional hardware inputs that can also be used as software signals:
- enabling the counting function
- accept default value
- freeze counter value

NOTE: The operating modes are described in Description of Operating Modes *(see page 19)* . See Configuration of Output Words *(see page 63)* and Status Messages and Count Values *(see page 87)* for the configuration and diagnostic data for these functions. Refer to Setting Parameters for the AEC DFB-Block *(see page 97)* for examples of the configuration of counter operation modes.

Event Counting

The module is suitable for the evaluation of fast count impulses and for specific reactions if preset values are exceeded in positive or negative direction.

Repeating Counters (Infinite Counts)

In this operating mode the module counts to the previously transferred modulo value and subsequently jumps to the 0 value, and counts from then on. If the value 0 is exceeded during down counting, the count value jumps to the modulo value. Only positive modulo values are acceptable.

NOTE: The repeating function can be activated for each operating mode by the transfer of a positive modulo value (reference number 7). The operating modes C, D, and E for absolute encoders are exceptions.

Frequency Measurements

In this operating mode, frequencies up to 200 kHz can be measured. The time base can be varied in a range from 0.1 ms to 1000 ms.

Period Measurements

In this operating mode, the duration of a period can be measured. To do this the pulses are counted for the duration of the gate time. Various time bases can be selected according to the duration of the period. There are 5 time bases available, from 1ms to 10,000 ms.

Clock Output (Pulse Generator)

Pulses generated through the module can be distributed through the outputs Q1 (counter 1) and Q2 (counter 2). Pulses with a pulse-width of 1 ms up to 1000 s can be distributed. See Operating Mode 8: Impulse Counter with Time Base (RPM Measurement) *(see page 28)*.

Incremental Path Evaluation

Path evaluation with incremental encoders occurs according to the counting procedure. The measuring system must therefore be reset after switching on or voltage loss (accepting preset values). The encoder then transmits a reference signal (zero impulse). In order to identify the direction of spin while turning forward or backward, the encoder sends two periodical square wave signals in quadrature, which are evaluated and counted correspondingly in the AEC.

To allow data transfer at higher frequencies, the signals can also be transmitted as differential signals corresponding to the RS 422, so that interfering impulses as well as common-mode interference can be recognized and filtered out. In this case, six lines are required for the data transfer (two each for the three-count inputs).

Accepting reference values (accepting preset values)

If the current positions are lost because of voltage loss or disconnection, the 170 AEC 920 00 measuring system must be reset when the voltage returns or when it is reconnected (accepting preset values). The encoder will transmit a reference signal (zero impulse) to do this.

There seven different possibilities available for the acceptance of a preset value.

An acceptance of the preset value is also necessary after every new enable of the counting channel; otherwise, the digital outputs will not be operated.

So that the point of reference is constantly approached from one direction, the reference point switch should be installed just in front of a hardware limit switch.

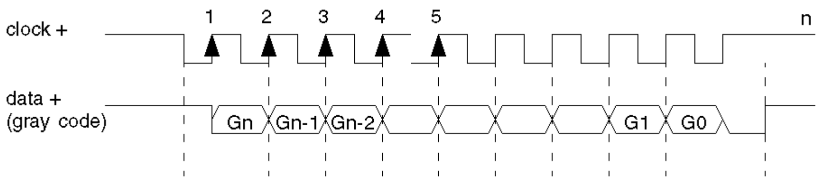
Absolute Path Evaluation

In absolute path evaluation, a numerical value is assigned to each position. This task is undertaken by an absolute encoder. The numerical values exist in the encoder as a code pattern (e.g. on code slices in dual code, gray code, or similar). The advantage of this type of encoder is that the absolute position is available immediately after it is switched on.

The determination of the actual position is carried out as follows:

The 170 AEC 920 00 requests the position value through a clock pulse sequence. The absolute position existing in the encoder is saved with the first clocking signal of the170 AEC 920 00 and transmitted to the 170 AEC 920 00 as a serial data telegram (Gn…G0) synchronously to the clock signal. The length of the data stream to be transmitted is dependent on the resolution and the data format of the encoder and can be defined using configuration words. With standard codes the resolution is n=24.

SSI - data and clocking telegrams



This data transfer is conducted through a synchronous serial interface of four lines (two each for clock signal and data).

To allow data transfer at higher frequencies, the signals are transmitted as differential signals corresponding to RS 422 so that interfering impulses can be identified and common-mode interference filtered out.

Chapter 2
Description of the Operating Modes

Overview

This chapter describes all current operating modes in which the counter can function. The operating modes for each counter are set individually over output words 1 and 2.

Further information can be found in Configuration *(see page 61)*.

What Is in This Chapter?

This chapter contains the following topics:

Overview of the Operating Modes

Overview

The following table gives an overview of the current operating modes:

Operating Mode	Encoder Type *)	Function
0	-	Channel not ready, Parameters not reset, Output = 0
1	imp	Down counter
2	imp	Up counter
3	ink	corresponds with operation mode "0"
4	ink	Up/down counter, path evaluation, 1/1-logic
5	ink	Up/down counter, path evaluation, 4/1-logic
6	imp	Differential counter: Counter input A = up; Counter input B = down
7	imp	Up counter /Down counter: Counter Input A = up/down; Counter Input B = Direction (1 = up, 0 = down)
8	imp	Impulse counter with time base (e.g. for variable speeds counting, Cv factors, etc) a) with external Clock Signal on counter input B as time base or b) digital output (Q) as time base on counter input B
9	imp	Period meter with 5 time bases for full or half period, full period 0 = no time base, 1 = 1, 2 = 10, 3 = 100, 4 = 1 000, 5 = 10 000 [micro sec]; half per.. 9 = 1, A = 10, B = 100, C= 1 000, D = 10 000 [micro sec]
A	imp	Frequency meter with 5 time bases for full or half period; whole period 0 = no time base, 1 = 0.1, 2 = 1, 3 = 10, 4 = 100, 5 = 1 000 [ms]; half period 9 = 0.1, A = 1, B = 10, C= 100, D = 1 000 [ms]
B	-	corresponds with operation mode "0"
C	abs	Path evaluation with single-turn encoders (SSI), 12 bit resolution
D	abs	Path evaluation with multi-turn encoders (SSI), 24 bit resolution
E	abs	Path evaluation with multi-turn encoders (SSI), 25 bit resolution
F	-	Software-Reset. In this instance both counters are always set back, regardless of the operation mode for counter 1 or 2 being invoked.

NOTE: *) Explanation of encoder type:
inc = incremental encoder
abs = absolute encoder
imp = impulse encoder

NOTE: 0, 3, and B are not really operating modes. The counter is in Zero Status, that is, in a determinated and stable status, and it is inactive.

Common Counter Properties

Counter Types

The two counters of the 170 AEC 920 00 I/O unit can only be operated as a group, either with incremental, pulse, or absolute encoders.

Counter Resolution

The resolution of the counter is 24 bit maximum (signed); corresponding to decimal values of -16 777 216 … +16 777 215. The count range used is defined through the operating mode. There are thirteen operating modes available.

5 V / 24 V Counter Inputs

Encoders with 5 V differential signal (RS 422) as well as encoders with 24 V signal (single-ended) can be connected to the module.

Preset Value (Preset)

With the preset value (preset) the counter can be loaded with a freely definable value from the PLC. The acceptance of the preset value is dependent on the preset mode as well as the digital inputs. In this case digital input 1 is assigned to counter 1, and digital input 4 is assigned to counter 2. If no preset value is transmitted from the PLC, then 0 is applied as the preset value in the counter.

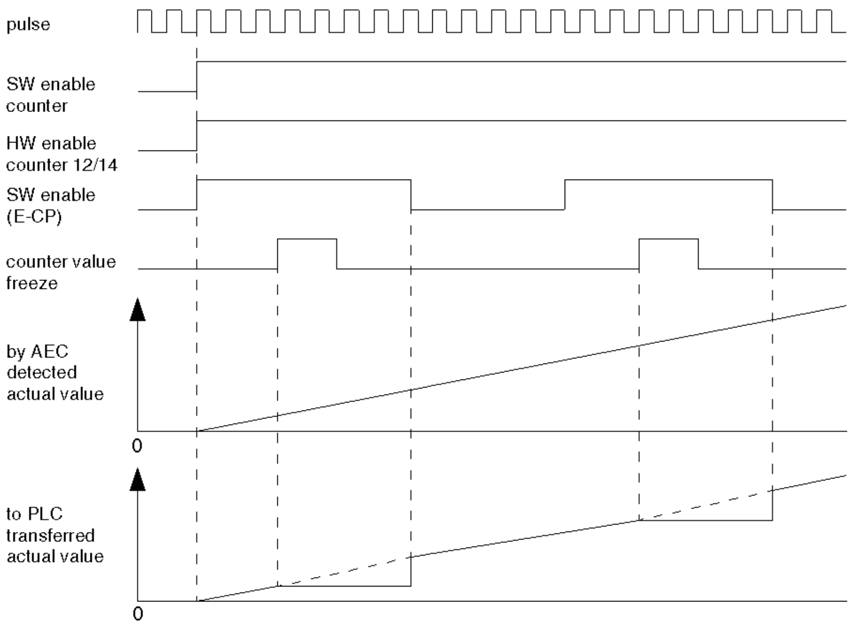
Software Limit Switch

The operation range of the counter can be specified with the upper and lower software limit switch. If the limits of the software limit switch are exceeded, the digital outputs will be switched off, and an error message will be generated. The software limit switches are only active after the parameters for the upper and lower software limit switch have been transferred.

Freeze Current Counter Value (Capture Function)

With this function the current counter value is relayed into an additional register. The counter operates independently of this function. This function is particularly useful for measuring pulses or paths. The counter value is frozen after enabling through software (Bit E_CP) and through an edge at hardware input I3 for counter 1 and I6 for counter 2. After the frozen counter value is accepted it is transferred to the PLC in actual values until the Bit E_CP is reset by the software. After being reset the actual value of the counter is transmitted.

Pulse diagram of freezing counter value



Event Processing

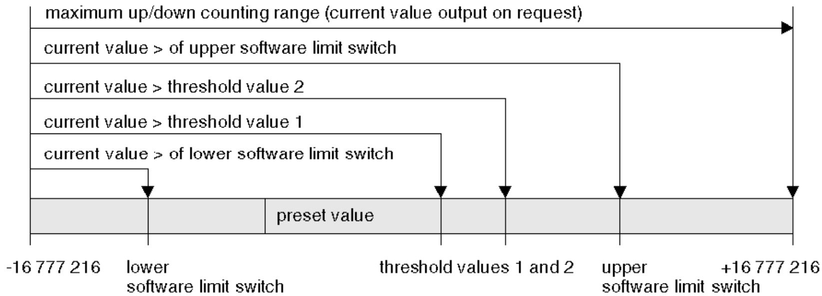
The user has the option of assigning event-controlled functions to the outputs. The digital outputs are set when the defined event has occurred.

The following events can be defined:
- counter value = threshold value 18
- counter value >= threshold value 18
- counter value <= threshold value 18
- counter value >= threshold value 1 and < threshold value 2

Further information can be found in Reference Numbers for Set Data (Output Words 3 and 4 (Bits 0 ... 4) *(see page 75)*.

The terms used in this book are explained below:

Definition of term



The counting pulse signals are dependent on the type of encoder. The I/O unit can process signal levels of 5V or 24V.

For this reason there are two counter inputs available for each of the two counters.
- 5V-differential signals (channels A+, A-; B+, B-; Z+, Z-)
- 24V-differential signals (channels A*, A-; B*, B-; Z*, Z-)
- 24V single-ended signals (channels A*, B*, Z* connected with the relationship of the encoder potential. Switch off the encoder monitor.)

Digital Inputs to Control Counters

The digital inputs (counter enable, preset value and selection of current counter status) are only effective in combination with the corresponding software signals.

NOTE: With 5V and 24V signals the counter inputs can operate using configurations with and without filters. When the filter is activated (used with mechanical contacts), the count frequency is reduced (max. 20 kHz).

Digital Outputs to Control Actuators

The digital outputs operate in two ways:
- through configured links in the user program
- through forcing in the configuration (possible anytime)

How the outputs become effective is specified in the counter configuration. See Configuration of the Digital Outputs *(see page 77)*.

Channel-specific Error Messages

The user can obtain detailed indications as to the nature of the error at the counter input through the error word. This can be:
- error in the supply voltage for the encoder
- running over or under the measuring range
- faulty encoder
- faulty encoder connection

These errors are reported through the input word. See Status Messages and Count Values *(see page 87)*.

Receiving the Preset Value into the Counter (Preset Mode)

With the preset value (preset) the counter can be loaded with a freely definable value from the PLC. The acceptance of the preset value is dependent on the preset mode as well as the digital inputs. In this case digital input 1 is assigned to counter 1, and digital input 4 is assigned to counter 2.

The following preset modes are available:

Preset Mode	Function
0	No preset value
1	The preset value is accepted with a positive edge at the digital input **Preset**.
2	The preset value is accepted with a negative edge at the digital input **Preset**.
3	The preset value is accepted with a rising edge of the hardware input **Preset**. The counter has stopped. The counter starts again with the falling edge of the hardware input.
4	The preset value is accepted with a positive edge (during upward counting) or with a negative edge (during downward counting) on the digital input **Preset**.
5	The preset value is accepted with a negative edge (during upward counting) or with a positive edge (during downward counting) on the digital input **Preset**.
6	Reference point with short cam signal
7	Reference point with long cam signal

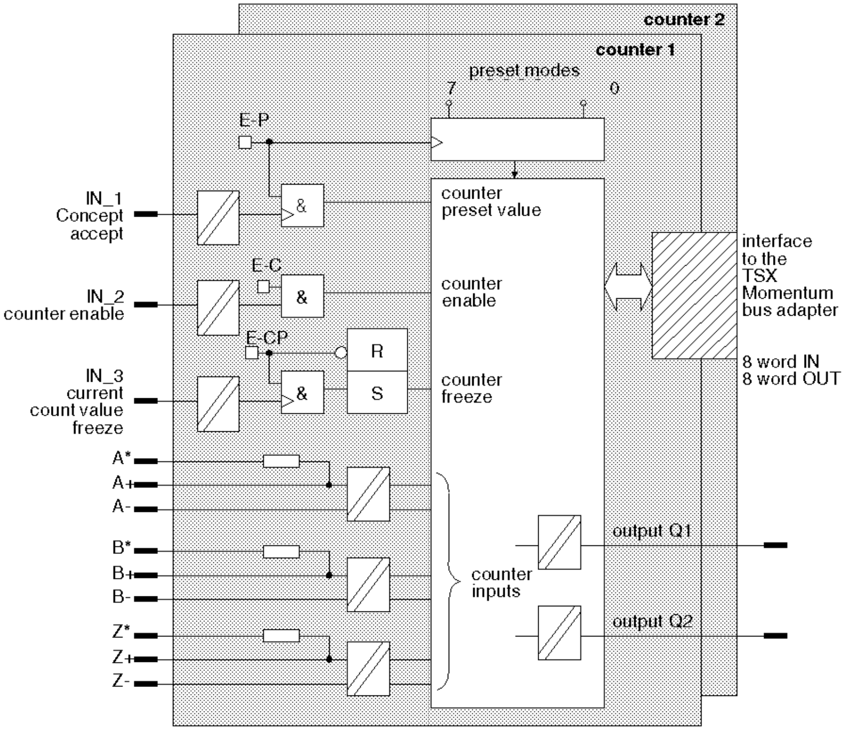
In preset modes 6 and 7, the zero pulse from the encoder (counter input Z) is used for the reception of the preset value. The encoder gives out this counting pulse after every full rotation.

The preset mode can be set. See Preset Modes (Output Words 1 and 2 (Bits 12 ... 14) *(see page 70)*. The preset modes are not applicable in all operating modes (frequency, period and pulse counters).

Count Channel for Count Functions with Pulse and Incremental Encoder

Functional Principle

The configured links for software and hardware show the correlations for incremental encoders.



Operating Modes for Pulse and Incremental Encoders

Overview

Operating modes 1 ... A are described below.

Operating Mode 1: Down Counter for Pulses

In this operating mode, all pulses of counter input A are used for down counting, beginning from a preset value (default = 0). Counter input B has no function. Pulse encoders with 5V differential output as well as pulse encoders with 24V single ended output (24V initiators) can be connected. Two digital outputs can be controlled using two programmable threshold values. See the example Up Counter (Mode 2) *(see page 104)*.

Operating Mode 2: Up Counter for Pulses

In this operating mode, all pulses of counter input A are used for up counting, beginning from a preset value (default = 0). Counter input B has no function. Pulse encoders with 5V differential output as well as pulse encoders with 24V single ended output (24V initiators) can be connected. Two digital outputs can be controlled using two programmable threshold values. See the example Up Counter (Mode 2) *(see page 104)*.

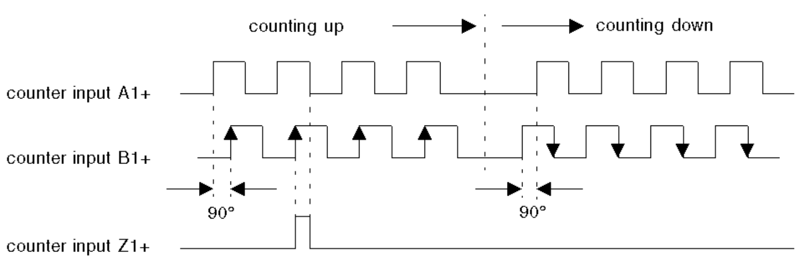
Operating Mode 3: Reserved

Corresponds with operating mode 0.

Operating Mode 4: Counting with Incremental Encoder with 1/1 Logic

Position measurement with incremental encoders is carried out according to the counting procedure. The measuring system must therefore be reset after switching on or power failure. The encoder transmits a reference signal (zero pulse) to do this. In order to identify the direction of spin when counting up or down, the incremental encoder sends two periodical square wave signals in quadrature, which are evaluated by the 170 AEC 920. Two digital outputs can be controlled using two programmable threshold values.

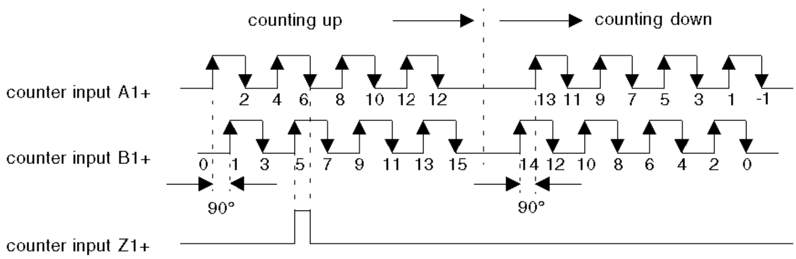
Pulse diagram of incremental encoder with 1/1 logic



Operating Mode 5: Counting with Incremental Encoder with 1/4 Logic

As with operating mode 4, but with fourfold resolution, as each edge of counter input A and B is evaluated. See Up Counter (Mode 2) *(see page 104)*.

Pulse diagram of incremental encoder with 1/4 logic

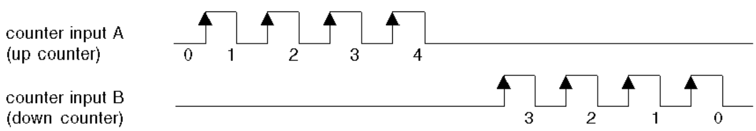


NOTE: In operating modes 4 and 5, the differential signals are not displayed.

Operating Mode 6: Differential Counter

In this operating mode, all pulses at counter input A cause the counter to count up, and all pulses at counter input B cause it to count down. This means that in this operating mode the difference is established between counter input A and counter input B. Two digital outputs can be controlled using two programmable threshold values.

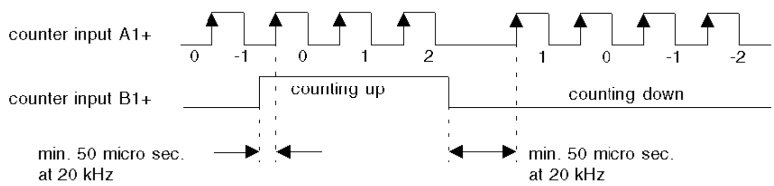
Differential counter pulse diagram



Operating Mode 7: Up/Down Counter with Direction Signal

In this operating mode all pulses at counter input A corresponding to the valence at counter input B are counted either up or down. With signal 1 at counter input B counting proceeds upwards, with signal 0 at counter input B counting proceeds downwards. Two digital outputs can be controlled using two programmable threshold values.

Pulse diagram of up/down counter



Operating Mode 8: Pulse Counter with Time Base (RPM Measurement)

This operating mode is suitable for determining velocities, rates of flow or rotary speeds. The pulses are counted and saved during a selected time base (gate opening time). Then the counter is reset and the counting process starts again.

The gate opening time can be controlled through two modes.

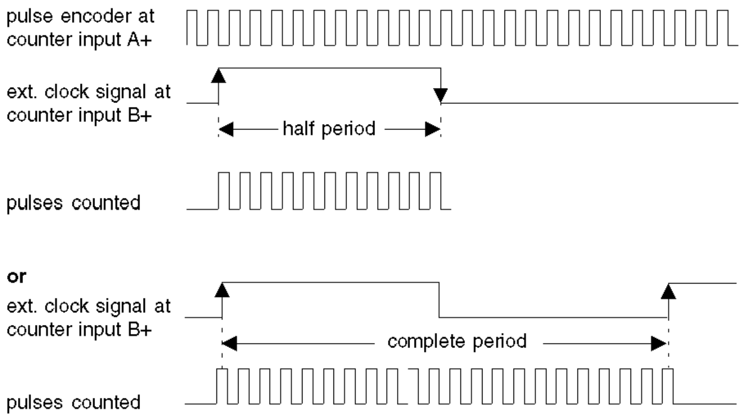
- an external clocking signal
- an internal clocking signal transmitted through digital outputs Q1 or Q3. These outputs must be configured (output words 3 and 4) as frequency outputs (Function D). The frequency must also be selected through reference number B.

The count duration results from the positive edge to the negative edge of the clocking signal (half period) or from one positive edge to the next (full period). This is also defined in output words 3 and 4.

NOTE: The digital inputs Accept Preset Value, Counter Enable, and Freeze Current Counter Value have no role in this operating mode. Only the frequency output function is available for the digital outputs. See Output Word 4 *(see page 75)*.

Example 1

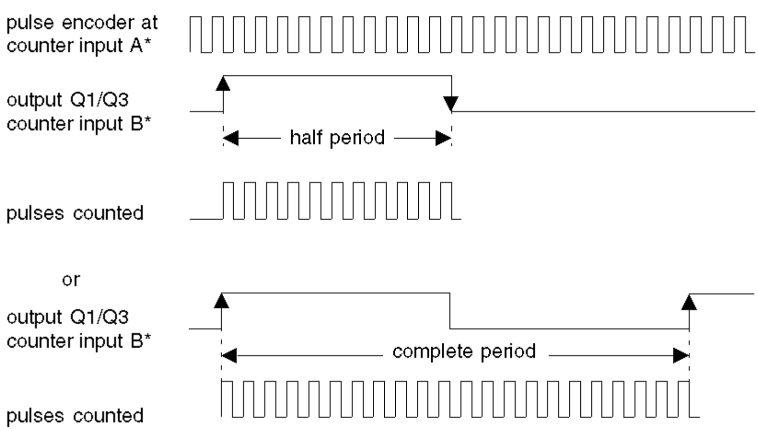
Pulse counting with external clocking signal (e.g. 5V level)



NOTE: When an external clocking signal of a 24V level is used, the external clocking signal must be connected to counter input B*.

Example 2

Pulse counting with internal clocking signal (24V level only)



If no external clocking signal is available, digital outputs Q1/Q3 can be configured as frequency outputs. However, as the outputs are only available at 24 V level, the corresponding output Q1/Q3 must be connected with the 1M to counter input B* and B-.

Operating Mode 9: Period Meter with 5 Time Bases

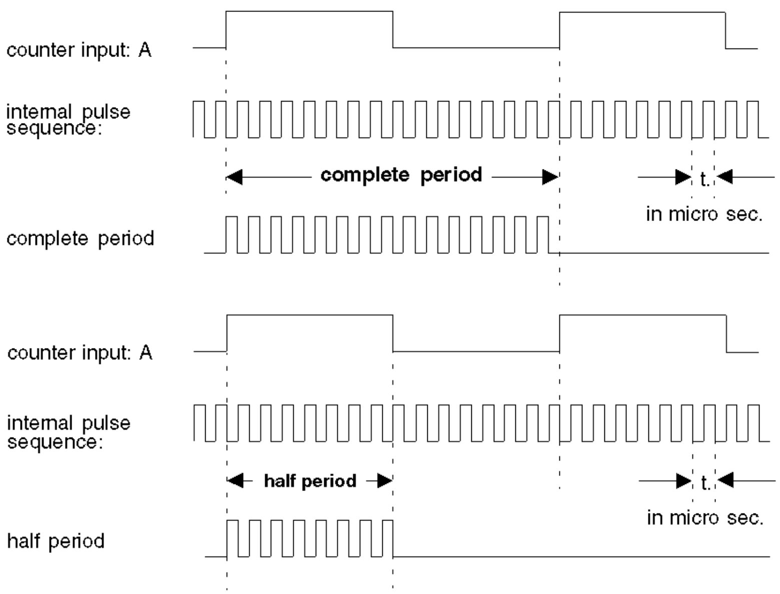
This operating mode measures the duration of a period. To do this the pulses are counted for the duration of the gate time. Various time bases can be selected according to the duration of the period. There are 5 time bases available, from 1ms to 10,000 ms.

This operating mode is used to acquire time measurements for processes.

NOTE: The time base should be chosen to achieve the desired accuracy and ensure the measuring time of the counter is not exceeded.

Full as well as half periods can be measured depending on the process.

Full period means the measurement of a series of pulses from positive to positive edge.



NOTE: Half period means the measurement of a series of pulses from positive to the next negative edge.

Operating Mode A: Frequency Meter with 5 Time Bases

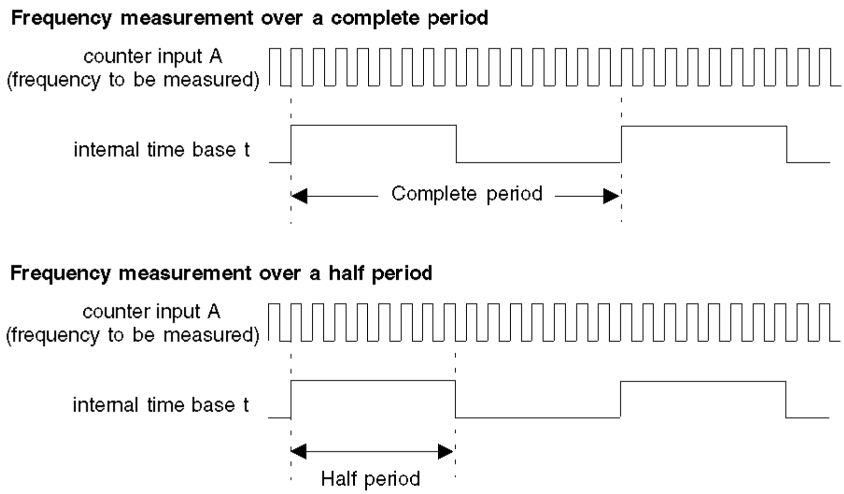
In this operating mode the number of pulses per unit of time is measured. Various time bases can be selected according to the frequency to be measured. There are 5 time bases available, from 0.1 ms to 1000 ms.

NOTE: The time base should be chosen to achieve the desired accuracy and ensure the measuring time of the counter is not exceeded.

Full as well as half periods can be measured depending on the process.

- Full period means the measurement of a frequency from positive to positive edge of the time base.
- Half period means the measurement of a frequency from positive to negative edge of the time base.

Pulse diagram for full and half periods



Operating Modes for Absolute Encoder

Absolute Encoder with SSI Protocol

Absolute encoders with SSI protocol can also be connected to both counters of the 170 AEC 920 00. A mixed operation with incremental encoders and absolute encoders is not possible.

The functions that deviate from the incremental encoder only are described below.

NOTE: In operating modes C, D and E the input filter must be switched off.

Counter Resolution

The resolution of the two count channels is either 12, 24, or 25 bit. This corresponds to decimal values from +4096 to +33 554 431.

The following operating modes are possible with absolute encoders:
- C = Counting with a resolution of 12 Bit (Single-turn Encoder)
- D = Counting with a resolution of 24 Bit (Multi-turn Encoder)
- E = Counting with a resolution of 25 Bit (Multi-turn Encoder)

Encoder Offset

With the encoder offset the absolute position value of the encoder can be shifted. This shift is only permissible within the maximum encoder resolution. The defined offset is added to the current actual value through an 0–>1 edge on Bit E_P.

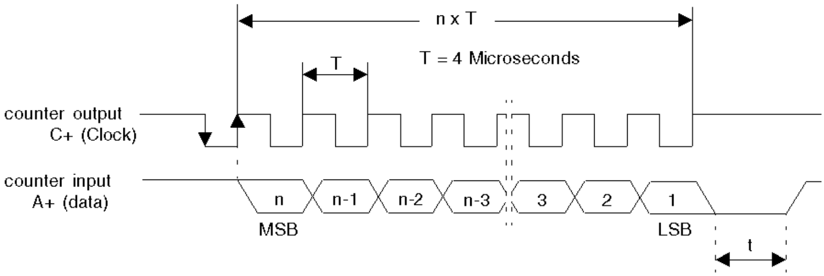
To make the absolute value of the encoder the machine zero point, the current actual position is transferred (negated) as the offset for the encoder. Through the addition of absolute value and offset carried out in the module, the actual value stands now at zero.

SSI = Synchronous Serial Interface

With the transfer of the absolute position, the absolute position data is transferred to a clock specified by the counter synchronously, beginning with the most significant bit (MSB).

The length of the data word may be 12 bit with single-turn encoders, and 24 or 25 bit with multi-turn encoders. Evaluations of parity bits or power failure bits are not provided.

Clock signal cycle for data format



Each clock signal edge triggers the transmission of a data bit. The clock signal frequency is specified by the module and amounts to 250 kHz.

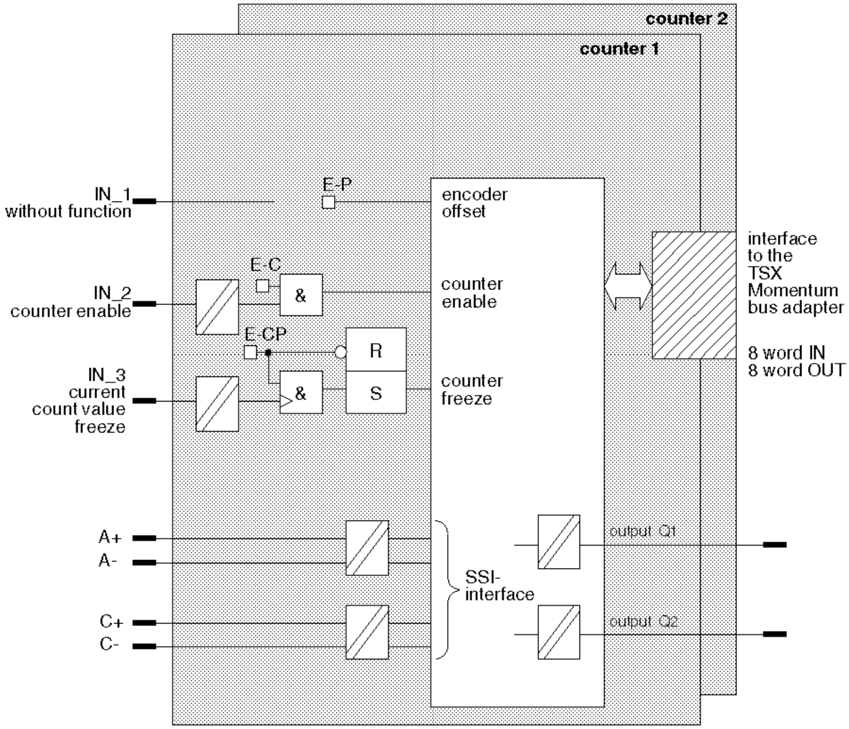
Clock signal and data signals stand at level 1 when non-operative. The current measurement is saved with the first falling edge. The data transmission occurs with the first rising edge.

After transmission of a data word, the data output stays at level 0 until the absolute encoder is ready for another measurement request (t). This time is dependent on the absolute encoder being used and amounts to approximately 30 microseconds.

Count Channel for Counting Functions with Absolute Encoders

Absolute Encoder Function Display

The configured links for software and hardware show the correlations for absolute encoders.



Operating Mode C: Channel Acquisition with Single-turn Encoders (SSI), 12-bit Resolution

Connection of an SSI encoder with one channel. The resolution amounts to 12 bits per rotation (single turn encoder).

Single turn encoders begin to count from 0 after one full rotation. They are suitable for procedures where the encoder does not use the whole rotation, or for applications where the number of rotations is not important (carousel, etc.).

See Up Counters (Mode 2) *(see page 104)* for an example of path evaluation with single-turn encoders.

Operating Mode D: Channel Acquisition with Multi-turn Encoders (SSI), 24-bit Resolution

The multi-turn encoder with 24-bit resolution delivers 12-bit resolution per rotation (4096 pulses), and can count 4096 rotations before overrunning. The advantage of the absolute encoder is that the absolute position is available immediately after it is switched on.

Operating Mode E: Channel Acquisition with Multi-turn Encoders (SSI), 25-bit Resolution

The multi-turn encoder with 25-bit resolution delivers 13-bit resolution per rotation (8192 pulses), and can count 4096 rotations before overrunning. The advantage of the absolute encoder is that the absolute position is available immediately after it is switched on.

See Up Counters (Mode 2) *(see page 104)* for an example of path evaluation with multi-turn encoders.

Chapter 3
TSX Momentum Adapter

Overview

TSX Momentum is a modular system. Bus adapters and CPU adapters work in connection with an I/O unit as standalone modules. In order to function properly, each I/O unit must be equipped with an adapter.

The following two sections give an overview of the available CPU and bus adapters.

What Is in This Chapter?

This chapter contains the following topics:

TSX Momentum Bus Adapter

Available Bus Adapters

The bus adapters are used in the I/O units as interfaces for numerous, industry-standardized, open communication networks.

The following bus adapters are available:

Model Number	Purpose
170 INT 110 00	INTERBUS
170 NEF 110 21	Modbus Plus, simple network cable and 984 data format
170 NEF 160 21	Modbus Plus, double network cable and 984 data format
170 PNT 110 20	Modbus Plus, simple network cable and IEC data format
170 PNT 160 20	Modbus Plus, double network cable and IEC data format
170 DNT 110 00	Profibus DP
170 FNT 110 00	FIPIO for TSX 7 and April
170 FNT 110 01	FIPIO for TSX Premium
170 LNT 710 00	DeviceNet
170 LNT 810 00	ControlNet
170 ENT 110 00	Ethernet

NOTE: Detailed Information about the individual bus adapters can be found in separate manuals. See Related Documents *(see page 9)*.

CPU Adapters and Interface Adapters of the TSX Momentum

CPU Adapters

The CPU adapter can be compared to the central unit of a PLC that runs a user program and controls process I/O points. It can be plugged into this I/O unit to control its I/O points as local I/O.

The following four CPU adapters are available:

Model Number	Internal Memory	Flash RAM	Clocking Speed	Interfaces
171 CCS 700 00	64 Kbytes	256 Kbytes	20 MHz	1 x RS-232
171 CCS 700 10	64 Kbytes	256 Kbytes	32 MHz	1 x RS-232
171 CCS 760 00	256 Kbytes	256 Kbytes	20 MHz	1 x RS-232 1 x I/O bus
171 CCS 780 00	64 Kbytes	256 Kbytes	20 MHz	1 x RS-232 1 x RS-485
171 CCS 780 10	512 Kbytes	-	32 MHz	1 x RS-232 1 x RS-485
171 CCS 760 10	512 Kbytes	-	32 MHz	-

The functionality of the CPU adapter can be expanded using an interface adapter. The interface adapter is connected between the CPU adapter and the I/O unit.

Interface adapters offer:
- time
- battery buffering
- additional communication interfaces

NOTE: Interface adapters can only be used in connection with a CPU adapter and not with bus adapters.

Three different interface adapters are available:

Model Number	Interfaces
172 JNN 210 32	32 Modbus interface which are RS-232 or RS-485 compatible
172 PNN 210 22	a Modbus Plus interface
172 PNN 260 22	Two (redundant) Modbus Plus interfaces

NOTE: Further information about CPU adapters and interface adapters can be found in the *Momentum M1 Processor Adapter and Option Adapter User Guide*.

The dimensions of modules assembled together (with and without interface adapters) are given in the *Modicon Momentum I/O Base User Guide*.

Part II
Module Description

Chapter 4
Structure of the 170 AEC 920

Overview

The following chapter provides an overview of the hardware structure of the fast counter module 170 AEC 920. Details of the wiring of the module and the signal assignments are described.

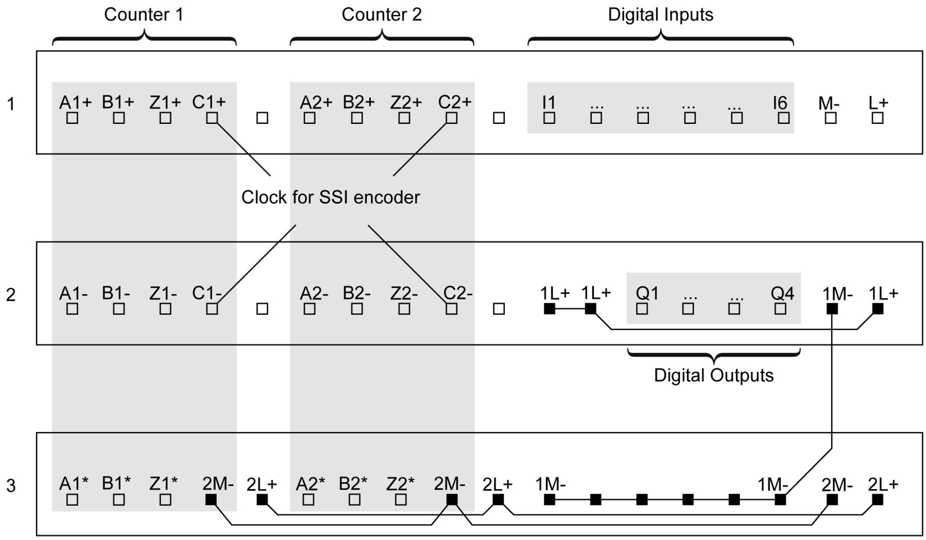
What Is in This Chapter?

This chapter contains the following topics:

Internal Connections and Meaning of Signals

I/O Unit

The figure below shows the internal connections of the I/O unit:



⚠ DANGER

SHORT CIRCUIT AND/OR SPIKES

Install external fuses as protective measure according to the fuse values provided in the wiring diagrams

A module unprotected by a fuse can cause short circuit and/or spikes.

Failure to follow these instructions will result in death or serious injury.

Assignment of Terminal Blocks

Connector 1

Terminal number	Signal	Function
1, 6	A1+, A2+	Positive differential input A (5 V), counter channel 1, 2
2, 7	B1+, B2+	Positive differential input B (5 V), counter channel 1, 2
3, 8	Z1+, Z2+	Positive differential input Z (5 V), counter channel 1, 2
4, 9	C1+, C2+	Positive clock output for SSI, counter channel 1, 2
11, 14	I1, I4	Digital inputs accept preset value, counter channel 1, 2
12, 15	I1, I5	Digital inputs counter enable, counter channel 1, 2
13, 16	I3, I6	Digital inputs, freeze current counter value for counter channel 1, 2
17	M-	Supply voltage -return line
18	L+	Supply for module +24 VDC

Connector 2

Terminal number	Signal	Function
1, 6	A1-, A2-	Negative differential input A, counter channel 1, 2
2, 7	B1-, B2-	Negative differential input B, counter channel 1, 2
3, 8	Z1-, Z2-	Negative differential input Z, counter channel 1, 2
4, 9	C1-, C2-	Negative clock output for SSI, counter channel 1, 2
13, 14	Q1, Q2	Digital output from counter channel 1
15, 16	Q3, Q4	Digital output from counter channel 2
17	1M-	-Return (+ 24 VDC Switching Voltage)
11, 12, 18	1L+	+ 24 VDC Switching voltage for digital outputs, supply voltage for digital inputs

Connector 3

Terminal number	Signal	Function
1, 6	A1*, A2*	Positive differential inputs A (24 V), counter channel 1, 2
2, 7	B1*, B2*	Positive differential inputs B (24 V), counter channel 1, 2
3, 8	Z1*, Z2*	Positive differential inputs Z (24 V), counter channel 1, 2
11 ... 16	1M-	-Return (+ 24 VDC Switching Voltage)
4, 9, 17	2M-	-Return (for encoder supply)
5, 10, 18	2L+	+5 ... +30 VDC supply voltage for encoder

Limit Frequencies and Cable Lengths for Incremental Encoders

Encoder type with signal level

Signal level	Cable length	Limit frequency (kHz)
5 V	100 m, shielded, twisted pairs	200 kHz
5 V	300 m, shielded, twisted pairs	300 kHz
24 V	300 m	10 kHz (Filter activated)

Limit frequencies and cable lengths for absolute encoders

Encoder type with	Cable length	Limit frequency (kHz)
RS 422	max. 100 m	Each one is determined by the 170 AEC 920 00

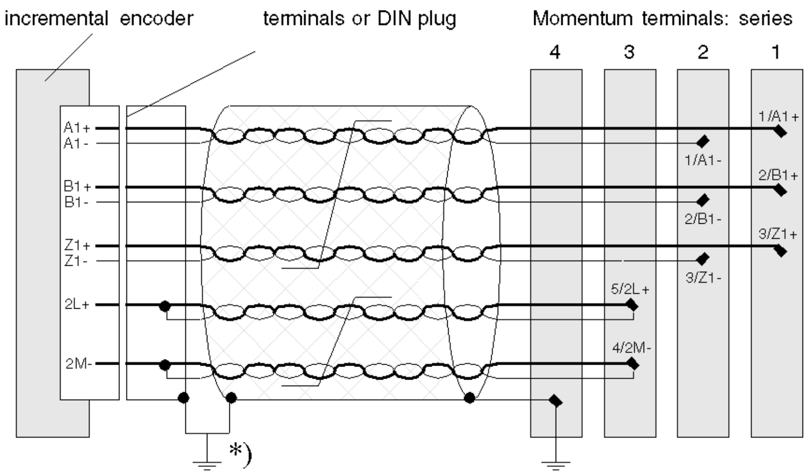
Wiring and Examples

Hints for Wiring

To protect count signals from external interference in push-pull or common mode, we recommend the following measures:

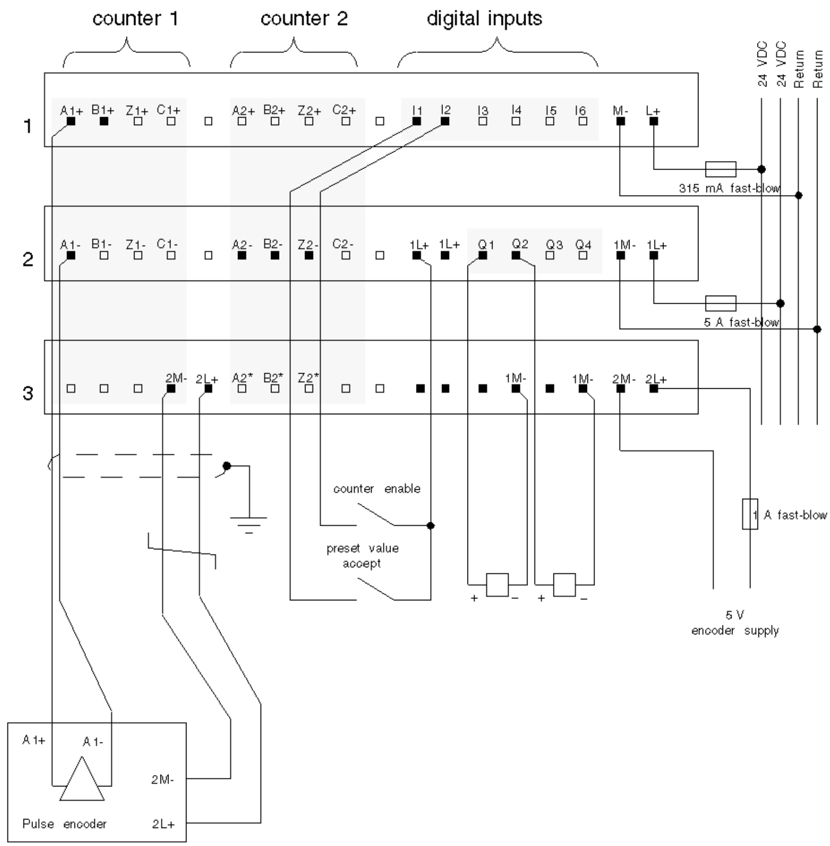
- Use shielded, twisted pair cables with a minimum line diameter of 0.22mm, two for the count signals.
- Ground the cable shield.
- Assuming that the same grounding is used, the counter inputs of the I/O unit can be connected with a multi-lead cable (twisted pair), which also supplies the encoder.
- For the encoder supply (principally 5 V), take note that the voltage drop amounts to ca 0.35 V with a cable length of 100m, 1 mm 2 line diameter and an encoder current consumption of 100 mA.
- Keep encoder cables and power supply leads or similar sources of electrical interference separate (distance as much as possible >0.5 m).
- The supply for encoders and periphery should be drawn from separate sources to achieve isolation.

Example of connection of an incremental encoder for 5 V (counter 1)

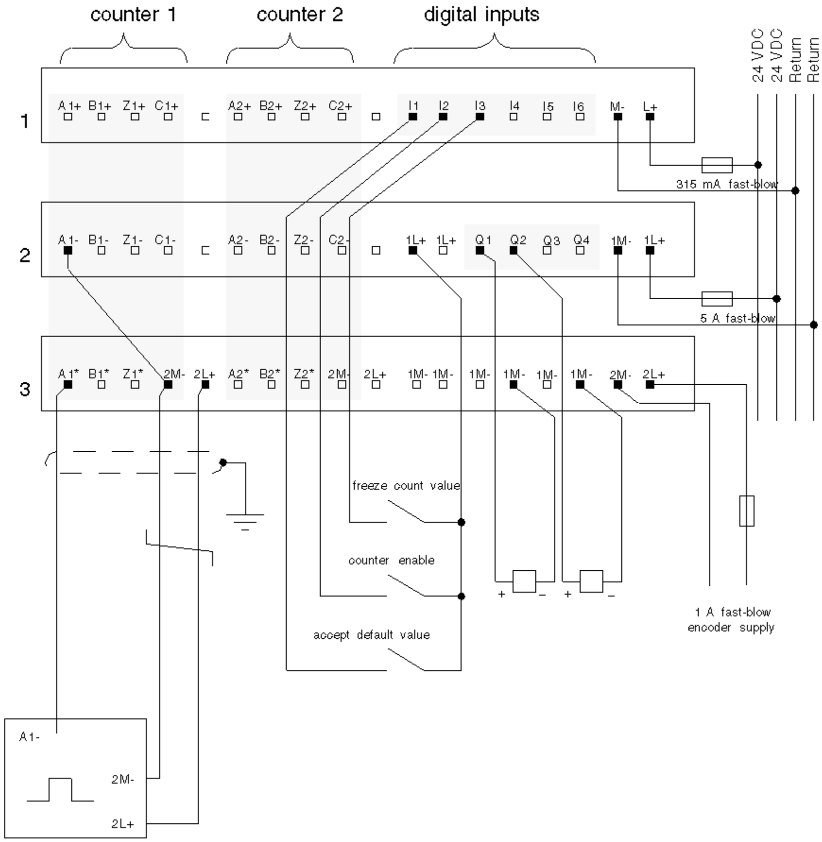


*) This link is established directly,
if the incremental encoder does not have a connection to ground.

Wiring example for pulse encoder (5 V)

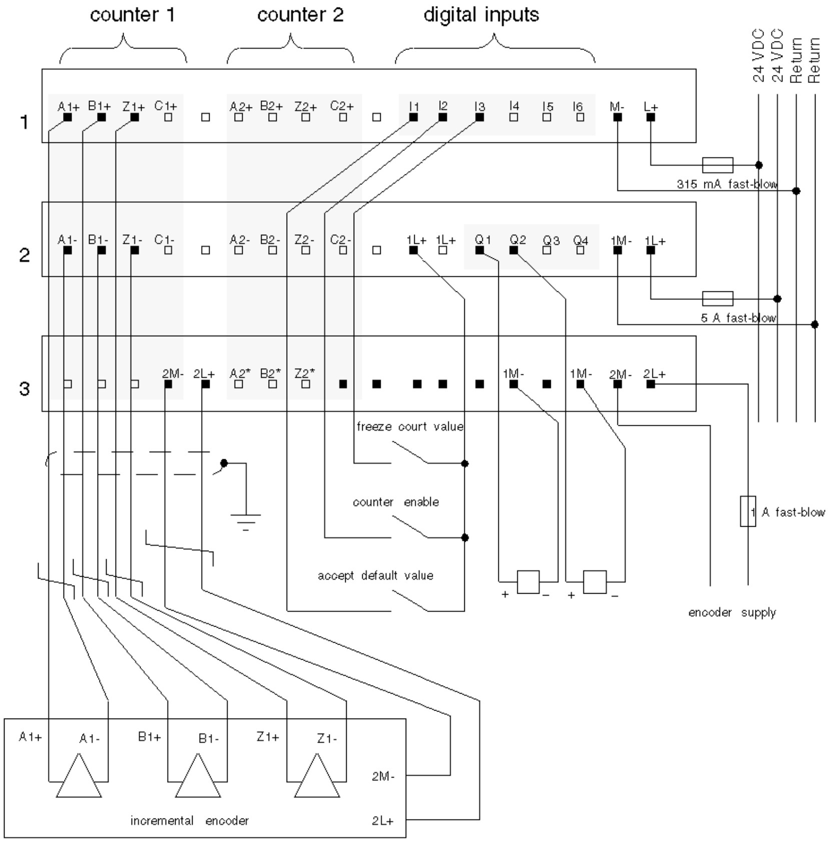


Installation example for pulse encoder (24 V)

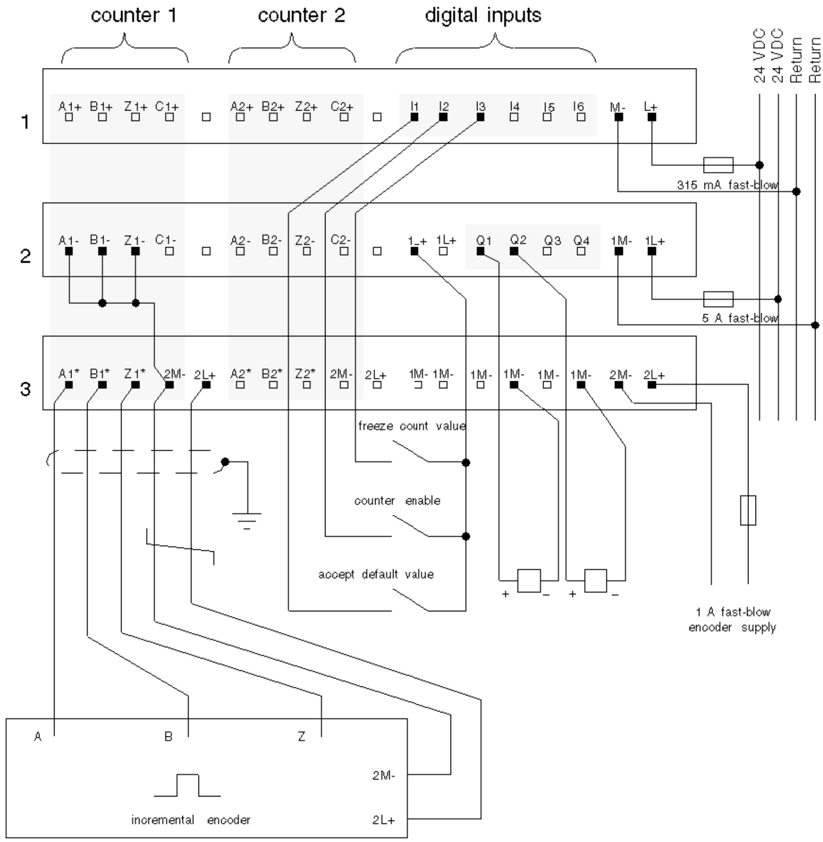


NOTE: The installation example refers to operating mode 1: down counting.

Installation example for incremental encoders (RS 422)

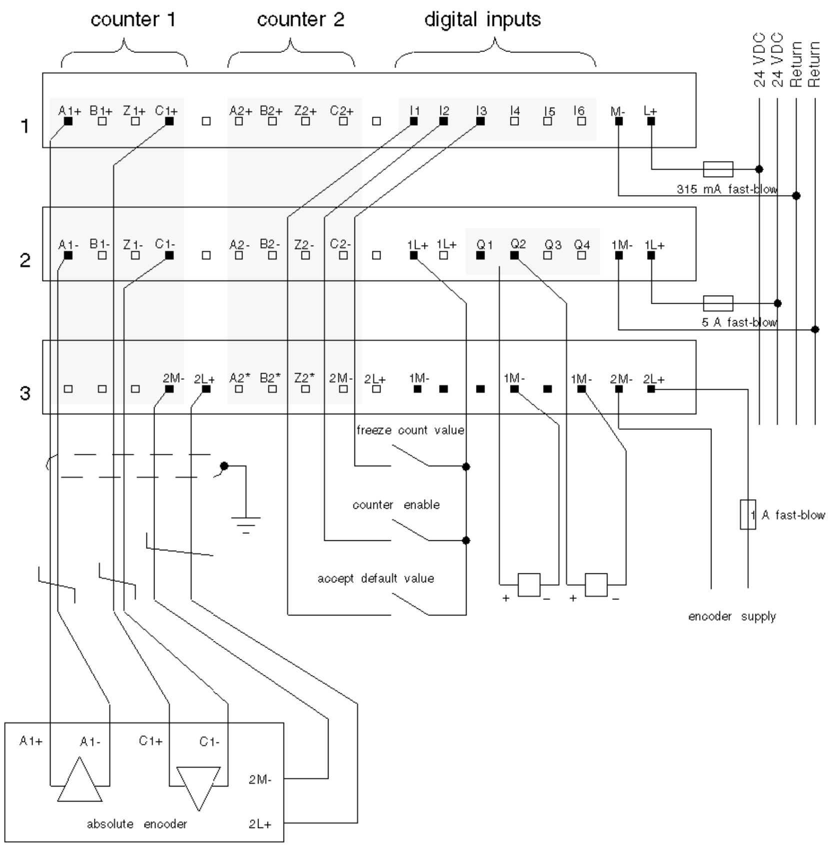


Installation for use as 24 V pulse encoder for A, B, and R line



NOTE: The installation example refers to operating modes 3, 4, and 5.

Installation example for absolute encoders with actuators

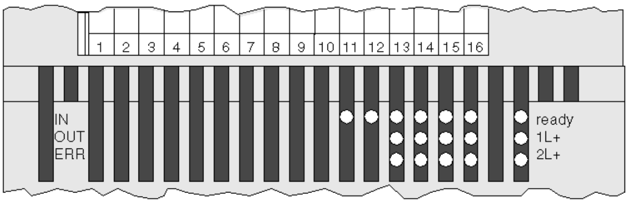


NOTE: The installation example refers to operating modes C, D, and E (absolute encoder SSI).

LED Status Indicators

LED Block

Front view of the LED block:



LED meaning

LED	Status	Meaning
ready	green	Ready for operation; supply voltage available for internal logic (5 V).
	off	Not ready for operation.
1L+	green	Turn-on voltage 1L+ for digital outputs Q1 ... 4 available.
	off	Turn-on voltage 1L+ for digital outputs Q1 ... 4 unavailable.
2L+	green	Supply voltage for encoder 2L+(5 … 30V) available.
	off	Supply voltage for encoder 2L+(5 … 30 V) 4 unavailable.
Top row IN 11 ... 16	green	Input status (depending on the LED input); input point active, i.e. "1" signal on the input (logic "ON").
	off	Input status (depending on the LED input); input point inactive, i.e. "0" signal on the input (logic "OFF").
OUT row 13 ... 16	green	Output status (one LED per digital output); output active, i.e. 1-signal on the output (logic "ON").
	off	Output status (one LED per digital output); output inactive, i.e. 0-signal on the output (logic "OFF").
Bottom row ERR 13 ... 16	red	Digital outputs overloaded (one LED per output); short circuit or overload of the corresponding output.
	off	Outputs Q1 … Q4 function as normal.

Technical Data

General Information

General information for the 170 AEC 920 00:

Type of module	2 quick counters (10 ... 200 kHz)
Supply voltage, encoder supply, starting voltage	24 VDC
Input current	6 mA at 24 VDC (Type 1+ or Type 2)
Max. load current	0.5 A/Output
ID-Code for Interbus	0633 hex1587 dec
Supply voltage	20 ... 24 ... 30 VDC
Current consumption	type. 200 mA at 24 VDC max. 350 mA
Power loss	4 W typical, 6 W maximum

Digital Inputs (Help Inputs)

Layout of inputs:

Encoder supply	24 V type., 30 V max.
Number of Inputs	6
Number of groups	2
Input	3 for every counter with the functions: a) accept preset value b) Enable counter c) Freeze count value
Type of signal	True High
IEC 1131 Type	1+
Signal level for 1-signal	+11 ... +30 VDC
Signal level for 0-signal	-3 ... +5 VDC
Input current	min. 2.6 mA for 1-Signal, max. 1.2 mA for 0-Signal,
Voltage range for inputs	-3 ... +30 VDC
Surge	Surge 45 Vp for 10 ms
Input delay (output counter)	max. 1 ms off to on, max. 1 ms on to off

Counter Inputs (for Pulses)

Layout of counter inputs:

Input types	5 VDC differential (RS422) or 24 VDC single ended
IEC 1131 Type	2
Count range (incremental)	24 Bit plus sign (-16 777 216bis +16 777 215)
(absolute)	25 Bit (0 to 33 554 431)

5 VDC differential

Maximum count frequency	200 kHz
Input voltage for 1-signal	minimum 2.4 VDC
Input current for 1-signal	> 3.7 mA
Input voltage for 0-signal	maximum 1.2 VDC
Input current for 0-signal	< 1 mA at 1.2 VDC

24 VDC single ended

Maximum count frequency	10 kHz
Input voltage for 1-signal	minimum 11 VDC
Input current for 1-signal	> 6 mA
Input voltage for 0-signal	-3 ... +5 VDC
Input current for 0-signal	< 2 mA at <= 5 VDC

Digital Outputs

Layout of outputs:

Output type	Semi-conductor
Switching voltage	20 ... 24 ... 30 VDC
Number of outputs	4
Number of groups	2
Switching current	max. 0.5 A/Output
Type of signal	True High
Leakage current	< 0.5 mA at 24 VDC
Voltage drop when on	< 0.5 VDC at 0.5 A
Overload protection	Outputs are protected against overloading and short circuits.
Error display	1 red LED per output (row 3) for short circuits/overloading
Error message	Error message (I/O-error) for the bus-adapter, if the module is defect (self-test by the I/O unit)

Output delay for resistive load	max. 0.1 ms 0 -> 1, max. 0.1 ms 1 -> 0
Maximum operation cycles	1 000/h inductive load 100/s resistive load 8/s Lamp load at 2.4 W
Definable functions	See Protective Measures, Certifications, and Mechanical Structure *(see page 56)*

Clock output for absolute encoder:

Output type	5 VDC differential (RS 422)
Output voltage for 1-signal	>+/- 2 VDC
Output current for 1-signal	> 20 mA

NOTE: If the outputs Q1 and/or Q3 are used as frequency outputs, the load must be at least 1kOhm.

Protective Measures, Certifications, and Mechanical Structure

Potential isolation between each other and against PE:

-digital I/O signals, -counter inputs, -clock outputs, -Supply voltage	500 VAC for 1 min.

Safety devices:

Internal	none
External: Supply voltage L+	315 mA fast-blow (with bus adapter)
External: Sensor and actuator supply1L+	Depending on the design of the current consumption of the connected sensors and actuators, max. 5 A fast-blow
External: Encoder supply 2L+	Depending on the design of the current consumption of the connected encoder, max. 1 A fast-blow

EMC for industrial use:

Resistance to disturbance	IEC 1131 surge voltage in the network supply 500 V, 12 Ohm
Emissions	EN 50081-2
Certifications	UL, CUL, CSA, CE

Mechanical structure:

Width	125 mm
Depth (without adapter)	40 mm
Height	141.5 mm without or with single bus bar 159.5 mm with double bus bar 171.5 mm with triple bus bar
Weight	240 g

Selecting a Momentum Adapter

Bus/CPU Adapters

Choose an appropriate bus or CPU adapter for your application and assemble it according to the instructions in the *Modicon Momentum I/O Base User Guide*.

⚠ CAUTION
ELECTRIC VOLTAGES PRESENT Unplug the terminal blocks before separating the adapter from the I/O unit. The I/O unit will be then be dead. This can be ensured by connecting the terminal blocks only after first assembling the adapter. When the I/O unit is connected to the power supply, electrical voltages are present. Make sure that there is no voltage present while the I/O unit has no adapter. **Failure to follow these instructions can result in injury or equipment damage.**

Selection of Terminal Blocks

Overview

For the connection of encoders as well as sensors and actuators to the I/O unit, suitable terminal blocks must be acquired. These can be found in the *TSX Momentum I/O Base User Guide*.

Part III
Configuration

Overview

This part deals with the configuration of the fast counter module 170 AEC 920 00. The DFB block AEC is described and a configuration example is given for each operating mode.

What Is in This Part?

This part contains the following chapters:

Chapter 5
Configuration of Output Words

Overview

By setting parameters for the output words, the counting functions, output configuration, and default values for the count channels of the 170 AEC 920 00 module are set.

To simplify open project creation, the functions of the output words for each bit will be explained.

What Is in This Chapter?

This chapter contains the following topics:

Configuration

Output Words

The eight output words for the counter are sent from the bus master to the I/O module with the following configuration data:

Address 4x: Output word 1

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Configuration for counter 1															

Address 4x +1: Output word 2

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Configuration for counter 2															

Address 4x +2: Output word 3

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Configuration of the digital outputs Q1, Q2 for counter 1								Reference numbers for set data and Open circuit monitoring counter 1							

Address 4x +3: Output word 4

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Configuration of the digital outputs Q3, Q4 for counter 2								Reference numbers for set data and Open circuit monitoring counter 2							

Address 4x +4: Output word 5 (Low word)

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Set data for counter 1 (low part)															

Address 4x +5: Output word 6 (High word)

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Set data for counter 1 (high part)															

Address 4x +6: Output word 7 (Low word)

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Set data for counter 2 (low part)															

Address 4x + 7: Output word 8 (High word)

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Set data for counter 2 (high part)															

NOTE: A detailed description of word functions can be found in Output Words *(see page 63)*.

Input Words

The bus master receives eight words from the I/O module containing information as follows:

Address 3x: Input word 1

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Module status bits for counter 1								Error bits for counter 1							

Address 3x + 1: Input word 2

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Module status bits for counter 2								Error bits for counter 2							

Address 3x + 2: Input word 3

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Output status counter 1								Reference numbers for set data 1							

Address 3x + 3: Input word 4

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Output status counter 2								Reference numbers for set data 2							

Address 3x + 4: Input word 5 (Low word)

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Current count word counter 1 (low part)															

Address 3x + 5: Input word 6 (High word)

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Current count word counter 1 (high part)															

Address 3x + 6: Input word 7 (Low word)

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Current count word counter 2 (low part)															

Address 3x + 7: Input word 8 (High word)

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Current count word counter 2 (high part)															

NOTE: A detailed description of word functions can be found in Status Words *(see page 87)*.

DFB Block

The DFB block is provided to simplify project creation using the 170 AEC 920 00 module.

NOTE: A detailed description of the AEC block can be found in DFB Description *(see page 97)*.

Summary of the Output Words

The 8 Output Words

8 output words are available for the configuration of the two counters of the 170 AEC 920 00.

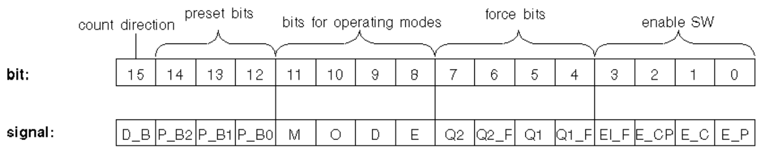
Summary of the function of the output words

Output Word	Function
1	Configuration bit for counter 1
2	Configuration bit for counter 2
3	Configuration of outputs/set data for counter 1
4	Configuration of outputs/set data for counter 2
5	Set points for counter 1 (Bit 0 … 15)
6	Set points for counter 1 (Bit 16 … 31)
7	Set points for counter 2 (Bit 0 … 15)
8	Set points for counter 2 (Bit 16 … 31)

Configuring Output Words 1 and 2

Bit/Signal Display

The following functions for counter 1 are determined with output word 1:



Meaning of the signals:

Signal	Meaning
D_B	If Bit 15 is set by the software, the count direction in all operating modes will be reversed
P_B2	3 bits for the choice of preset mode
P_B1	
P_B0	
M	4 bits for the choice of operation mode
O	
D	
E	
Q2	Valence entry for digital output Q2 (force to 0 or 1)
Q2_F	Activate force for digital output Q2 (1=active)
Q1	Valence entry for digital output Q1 (force to 0 or 1)
Q1_F	Activate force for digital output Q1 (1=active)
EI_F	Enable input filter 0 = without Filter (<= 200 kHz); 1 = with Filter (<= 20 kHz)
E_CP	Enable software to freeze count value
E_C	Enable software for counter
E_P	Enable acceptance of preset value

With SSI-encoders, the preset value and the software limit switch values must still be transmitted after the count directions of have been reversed.

With output 2 the same functions are determined for counter 2 (but Q3 instead of Q1 and Q4 instead of Q2 with digital outputs).

Enable Software and Filter (Output Words 1 and 2) Bits 0 ... 4

With bits 0 ... 4, the following functions are enabled.

D0 = E_P

1 = Enable acceptance of preset value (preset)

The preset value will be accepted after it has been enabled by the software with an edge at the hardware input I1/I4.

D1 = E_C

1 = Enable counters

The counter is enabled with a 1 signal on the hardware input I2/I5 after being enabled by the software.

D2 = E_CP

1 = Freeze count value enable (capture)

The count value is frozen with an edge at the hardware input I3/I6 after it has been enabled by the software. After the frozen count value has been accepted it will be transmitted as the actual value to the PLC, until the bit E_CP is reset again through the software. After being reset the actual value of the counter is transmitted. Pulses, which enter the count input after the count value has been frozen, continue being counted internally.

D3 = EI_F

1 = Activating the input filter of the count inputs

Through activating the input filter the input frequency of the counter is limited to < 20 kHz.

NOTE: It is necessary to activate the filter in order to prevent disturbances for 24V single-ended pulse encoders.

Force the Digital Outputs (Output Word 1 and 2) Bits 3 ... 7

The digital outputs can be switched on or off independently from the assigned function of the PLC counter (force).

D4 = Q1_F

1= activate forcing for digital output Q1

D5 specifies the valence of the output Q1.

D5 = Q1

This bit defines the valence of the digital output Q1 for forcing. 0 = output inactive, 1 = output active (24 V).

D6 = Q2_F

1= activate forcing for digital output Q2

D7 determines the valence of the Q2 output.

D7 = Q2

This bit defines the valence of the digital output Q2 for forcing. 0 = output inactive, 1 = output active (24 V).

Bit 8 to Bit 11 for Operation Modes (Output Words 1 and 2)

Bit 8 to bit 11 for operation modes (output words 1 and 2)

Operation Mode (Hex)	Bit 11 10 9 8	Type of Encoder	Function
0	0 0 0 0		Channel not ready, parameter reset back, output=0
1	0 0 0 1	pulse	Down counter
2	0 0 1 0	pulse	Up counter
3	0 0 1 1		corresponds with operation mode "0"
4	0 1 0 0	ink	Up/down counter, path evaluation, 1/1 logic
5	0 1 0 1	ink	Up/down counter, path evaluation, 1/4 logic
6	0 1 1 0	pulse	Difference counter: Counter input A = upwards; Counter input B = down
7	0 1 1 1	pulse	Up/down counter Counter input A = up/down; Counter input B = direction (1=up, 0=down)
8	1 0 0 0	pulse	Pulse counter with external time base (e.g. for speed counter, rate of flow, etc.) a) with external clock on the counter input B as time base or b) frequency output (Q1/Q3) as time basis on counter input B
9	1 0 0 1	pulse	Period meter with 5 time bases for full or half periods; 0= without time basis; half per.: 9 = 1, A = 10, B = 100, C= 1 000, D = 10 000 [ms] half per.: 9 = 1, A = 10, B = 100, C= 1 000, D = 10 000 [ms]
A	1 0 1 0	pulse	Frequency meter with 5 time bases for full or half periods; 0= without time basis whole period: 1 = 0.1 , 2 = 1. 3 = 10. 4 = 100, 5 = 1 000 [ms]; half period: 9 = 0.1, A = 1, B = 10, C= 100, D = 1 000 [ms]
B	1 0 1 1		corresponds with operation mode "0"
C	1 1 0 0	abs	Path evaluation with single-turn encoders (SSI), 12 bit resolution
D	1 1 0 1	abs	Path evaluation with multi-turn encoders (SSI), 24 bit resolution

Operation Mode (Hex)	Bit 11 10 9 8	Type of Encoder	Function
E	1 1 1 0	abs	Path evaluation with multi-turn encoders (SSI), 25 bit resolution
F	1 1 1 1		Software reset. In this instance both counters are always reset, regardless of this operation mode is called for counter 1 or 2.

Preset Mode (Output Words 1 and 2) Bits 12 ... 14

The preset values are accepted through the hardware input (I1 for counter 1, I4 for counter 2). If no preset value is transmitted from the PLC, a preset value of 0 will be accepted. But the SW enable must be set.

Preset mode

Bits	14 13 12	Function (Preset Modes)
hex 0	0 0 0	Preset value is accepted with SW-Bit E_P= 1 signal (the HW input I1/4 has no function)
hex 1	0 0 1	The preset value is accepted with the 0/1 edge of the HW-preset signal. See Preset Mode Hex 1 *(see page 71)**.
hex 2	0 1 0	The preset value is accepted with the 1/0 edge of the HW preset signal.*
hex 3	0 1 1	The preset value is accepted if the preset signal is 1, and the counter is stopped. The counter starts if the preset signal is 0. See Preset Mode Hex 3 *(see page 71)*.*
hex 4	1 0 0	The preset value is accepted with the 1/0 edge (up counter) and with 0/1 edge (down counter) of the preset signal. Application with axes control.*
hex 5	1 0 1	The preset value is accepted with the 1/0 edge (up counter) and with 0/1 edge (down counter) of the preset signal.*
hex 6	1 1 0	Reference point with short cam signal. See Accept Preset with Short Cam *(see page 72)*.*
hex 7	1 1 1	Reference point with long cam signal. See Accept Preset with Short Cam *(see page 72)*.*

*) SW Bit E_P must always be signal 1.

Reversals of the Count Directions E_P

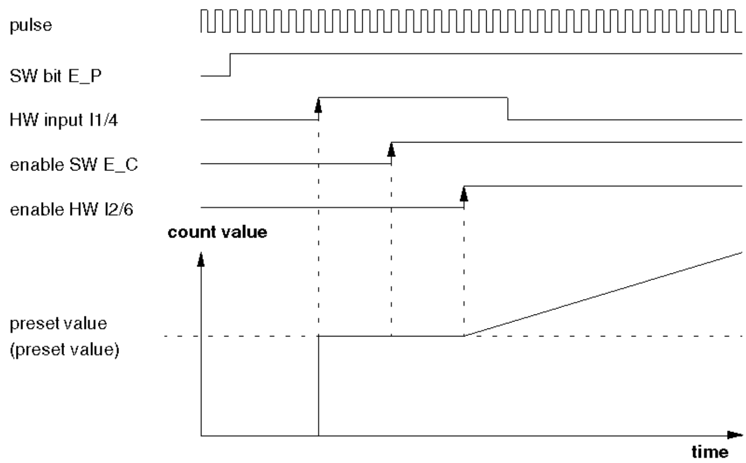
D15 = D_B

If Bit 15 is set to 1 by the software, the count direction in all operating modes will be reversed.

NOTE: With SSI encoders, the preset value and the software limit switch value must be transmitted again after the count directions have been reversed.

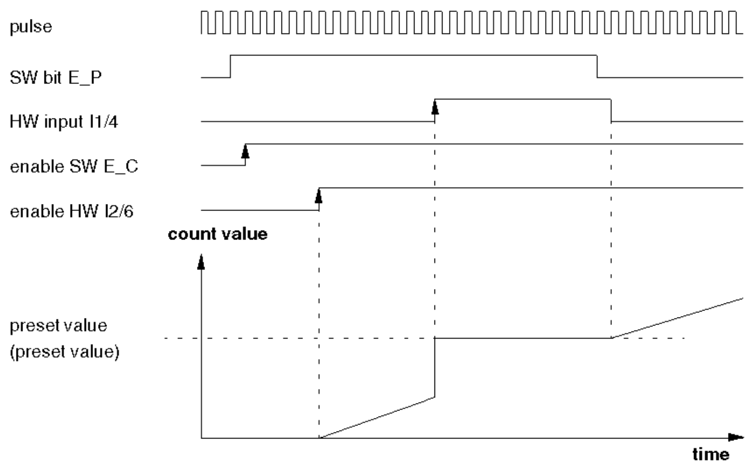
Preset Mode Hex 1

Explanation for preset mode (preset mode) hex 1



Preset Mode Hex 3

Explanation for preset mode (preset mode) hex 3



Preset Value Accepted with Short Cams

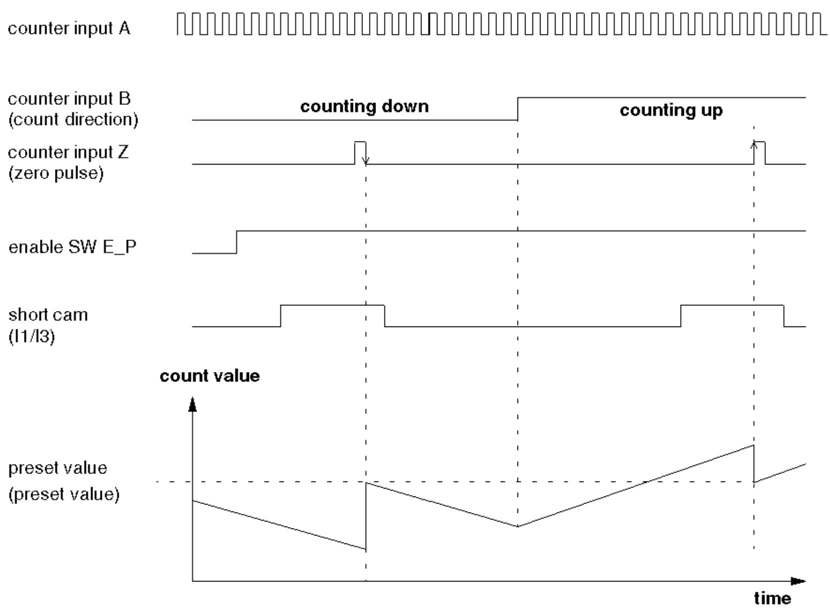
The preset value is accepted if the software enable (Bit E_P), the hardware input (I1/4), and the zero pulse are applied at the count input Z.

This function can be used if only a zero pulse is delivered from the encoder over the cam length. The down counter value is accepted with a falling edge of the zero pulse, and the up counter value with a rising edge. With incremental encoders, it is always accepted with the rising edge of the zero pulse, because the counter input B at the time of the zero-pulse is always 1.

NOTE: If the encoder delivers several zero pulses while the cam signal is on, the counter will be set to the preset value with every zero pulse.

The following clock diagram explains the setting to the preset value with a short cam signal.

Function of the short cam

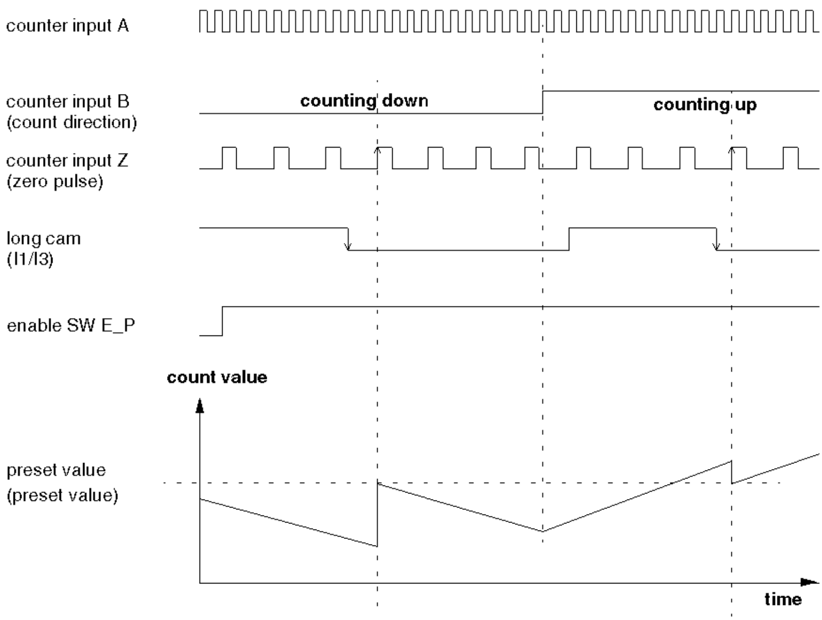


Preset Value Accepted with Long Cams

The preset value is accepted, with the first rising edge of the zero pulse on the count input, as a result of the 1 changing to 0 on the hardware input. For it to be accepted it is necessary for the software to be enabled via the Bit E_P.

NOTE: All other zero pulses have no effect.
The following clock diagram explains the setting to the preset value with a long cam signal.

Clock diagram for the preset value with long cams



Configuring Output Words 3 and 4

Output Words 3 and 4

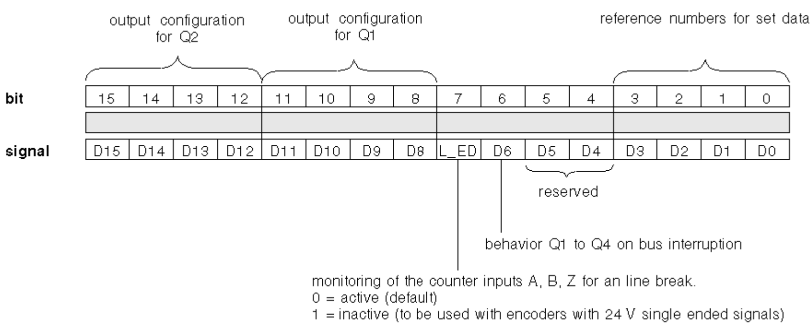
Output word 3 is used to determine the following functions for counter 1, while output word 4 is used for counter 2:

Output Word 3

Output word 3 is used to specify the following functions for counter 1:

- The meaning of the parameters which will be transferred to words 5 and 6 is specified using the reference numbers for set data (D0…D3).
- D4 and D5 are reserved
- D6, D7 behavior of the module during bus interrupt and line break of the counter inputs
- Output configuration of the digital output Q1 (D8 …D11)
- Output configuration of the digital output Q2 (D12 … D15)

Bit and signal representation of output word 3:

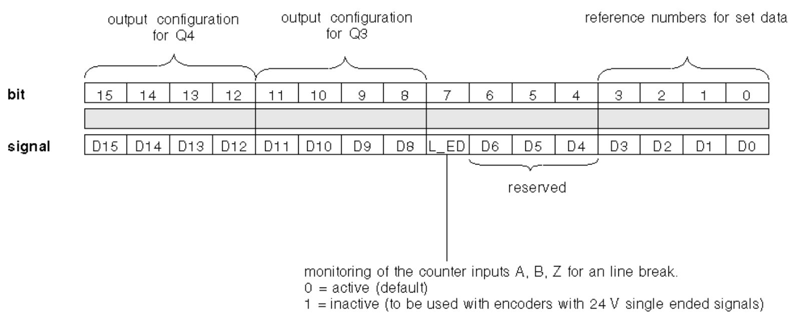


Output Word 4

Output word 4 is used to specify the following functions for counter 2:

- The meaning of the parameters which will be transferred to words 7 and 8 is specified using the reference numbers for set data (D0…D3).
- D4, D5, and D6 are reserved.
- D7 behavior of the counter during line break of the count inputs.
- Output configuration of the digital output Q3 (D8 …D11).
- Output configuration of the digital output Q4 (D12 … D15).

Bit and signal representation of output word 4:



Reference Numbers for the Command Data (Output Words 3 and 4) Bits 0… 4

The reference numbers can be used to send various set data to the module. Output word 4 can be used to determine the same functions for counter 2 (but with Q3 instead of Q1 and Q4 instead of Q2 for digital outputs).

Individually, these are as follows:

Reference Number	4 3 2 1 0	Function
hex: 0	0 0 0 0 0	No reference number selected
hex: 1	0 0 0 0 1	Reference number for preset value or SSI offset value
hex: 2	0 0 0 1 0	Reference number for threshold value 1*)
hex: 3	0 0 0 1 1	Reference number for threshold value 2*)
hex: 4	0 0 1 0 0	Reference number for lower software limit switch*) (Outputs will be disabled, if counting pulses >= value)
hex: 5	0 0 1 0 1	Reference number for lower software limit switch*) (Outputs will be disabled, if counting pulses <= value)
hex: 6	0 0 1 1 0	Reference number for pulse width of the digital outputs (Q) for counters 1 and 2 in ms
hex: 7	0 0 1 1 1	Reference number for modulo value with repeating counters; function can be disabled with the modulo value = 0.

Reference Number	4 3 2 1 0	Function
hex: 8	0 1 0 0 0	Reference number for time base in "period meter" counter mode
hex: 9	0 1 0 0 1	Reference number for time base in "frequency meter" counter mode
hex: A	0 1 0 1 0	Reference number for operating mode 8 (pulse counter with time base)
hex: B	0 1 0 1 1	Reference number for time base in ms for pulse at digital outputs Q1/3 (only for half cycles)
hex: C	0 1 1 0 0	Reserved
hex: D to F	0 1 1 0 1 0 1 1 1 1	Reserved (corresponds to reference number 0)

*) A HW or SW reset must be carried out to disable the functions. Value 0 is a valid parameter and does not disable this function.

Default Values

If no command data has been defined (no reference number selected), the following default values are assigned to the command data:

Function	Default values
Preset value or SSI offset value	0
Threshold values 1 and 2	not active
upper and lower software limit switch	not active
Pulse width of the digital outputs in ms	Value = 0, no output pulse
Modulo value	Value = 0, function not active
Period meter and frequency meter	without time base
Mode for pulse counter	complete period
Pulse counter with time base in ms	without time base
Line monitoring (encoder)	active
Q digital outputs	inactive

D5

Bit D5 is currently not used.

D6 = CLOA

This bit is used to determine whether the outputs are disabled after communication is interrupted (CLOA = 0) or whether the module continues to process the outputs (CLOA = 1). This function is only defined in the register for counter 1 and is effective for both channels.

D7 = L_ED

This bit can be used to disable line break monitoring of the counter inputs. The following applies:

0 = line break monitoring active

1 = line break monitoring disabled

NOTE: For encoders with a 24 DCV signal level (single-ended), bit L_ED must be set to 1 to disabled line monitoring.

Configuring the Digital Outputs

Various functions can be assigned to the digital outputs. 4 bits are available for configuration for each output.

- counter 1 output Q1 = bit 8 … 11 in word 3
- counter 1 output Q2 = bit 12 … 15 in word 3
- counter 2 output Q3 = bit 8 … 11 in word 4
- counter 2 output Q4 = bit 12 … 15 in word 4

The Functions of the Digital Outputs (Output Words 3 and 4)

The following is a table of the functions that can be assigned to the digital outputs:

Bits	11 10 9 8	Function (control of counter 1 digital outputs Q1/3)
Bits	15 14 13 12	Function (control of counter 1 digital outputs Q2/4)
hex: 0	0 0 0 0	Outputs carry 0 signal.
hex: 1	0 0 0 1	Output is set to 1 signal and remains saved if count value = threshold value 1.
hex: 2	0 0 1 0	Output is set to 1 signal and remains saved if count value = threshold value 2.
hex: 3	0 0 1 1	Output is set to 1 signal, if counter enabled output becomes 0, if count value = threshold value 1 (saving).
hex: 4	0 1 0 0	Output is set to 1 signal, if counter enabled output becomes 0, if count value = threshold value 2 (saving).
hex: 5	0 1 0 1	Output is set to 1 signal if count value = threshold value 1 (saving). Output is set to 0 signal if count value = threshold value 2 (saving).
hex: 6	0 1 1 0	Output is set to 1 signal if count value >= threshold value 1. Output is set to 0 signal if count value <=threshold value 1.
hex: 7	0 1 1 1	Output is set to 1 signal, counter enabled and count value < threshold value 1. Output is set to 0 signal if count value >=threshold value 1.
hex: 8	1 0 0 0	Output is set to 1 signal if count value >= threshold value 2. Output is set to 0 signal if count value < threshold value 2.
hex: 9	1 0 0 1	Output is set to 1 signal if counter enabled and count value < threshold value 2. Output is set to 0 signal if count value >= threshold value 2.
hex: A	1 0 1 0	Output is set to 1 signal if count value => threshold value 1. Output is set to 0 signal if counter value => threshold value 2.

Bits	11 10 9 8	Function (control of counter 1 digital outputs Q1/3)
Bits	**15 14 13 12**	**Function (control of counter 1 digital outputs Q2/4)**
hex: B	1 0 1 1	Trigger pulse if count value = threshold value 1; the pulse length can be defined (1 … 2 EXP 32 ms).
hex: C	1 1 0 0	Trigger pulse if count value = threshold value 2; the pulse length can be defined (1 … 2 EXP 32 ms).
hex: D	1 1 0 1	Frequency output (only for digital outputs Q1/3), a frequency must also be given via reference number B.
hex: E	1 1 1 0	Values reserved (as with hex 0, no report to bus adapter).
hex: F	1 1 1 1	

Clock Diagrams for the Function of the Digital Outputs

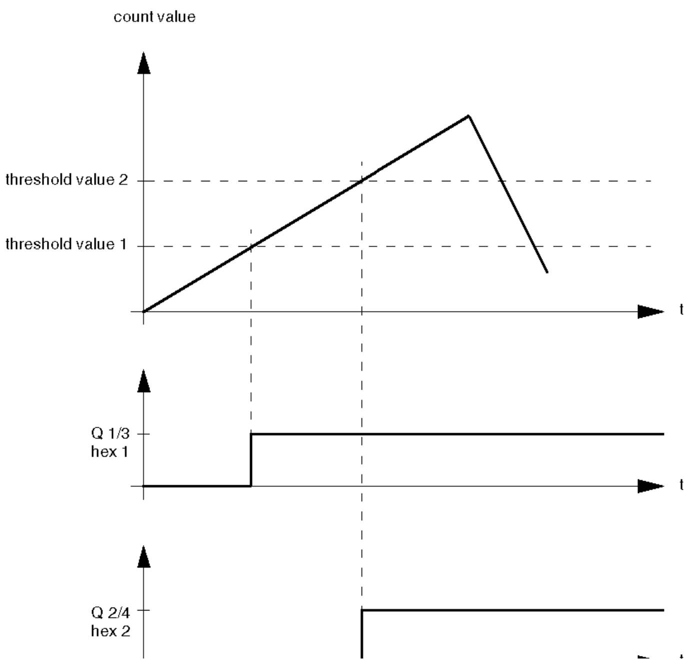
The following clock diagrams show the different output configurations for outputs Q1/3 and Q2/4.

Hex 1 and Hex 2 Output Behavior

Output Q1/3 is set to 1 signal and remains saved if the count value = threshold value 1 (hex 1).

Output Q2/4 is set to 1 signal and remains saved if the count value = threshold value 2 (hex 2).

Function: hex 1 and hex 2 output behavior

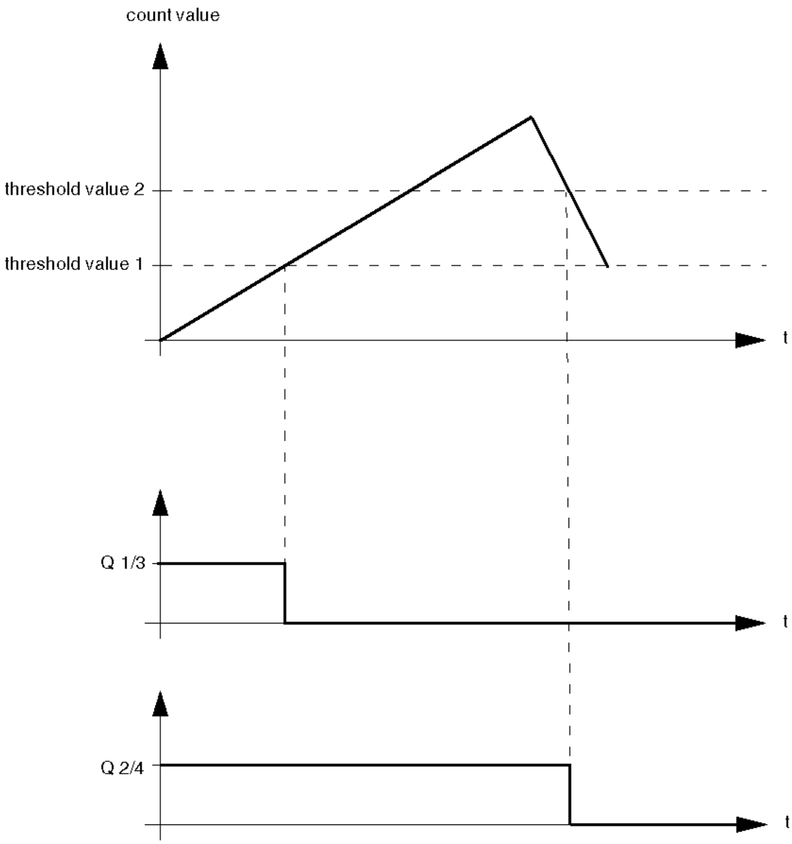


Hex 2 and Hex 4 Output Behavior

Output Q1/Q3 is set to 1 signal as soon as the counter is enabled. Output Q1/Q3 goes to 0 if the count value is equal to the threshold value 1 (saving).

Output Q2/Q4 is set to 1 signal as soon as the counter is enabled. Output Q2/Q4 goes to 0 if the count value is equal to the threshold value 2 (saving).

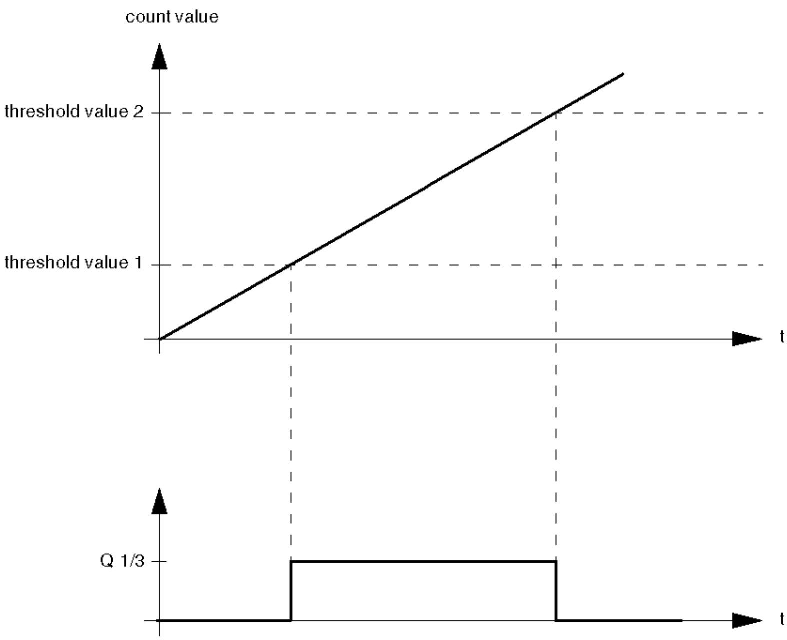
Function: hex 3 and hex 4 output behavior



Hex 5 Output Behavior

Output 1/Q3 is set to 0 signal if the count value is equal to the threshold value 1 (saving). Output 0/Q3 is set to 0 signal if the count value is equal to the threshold value 2 (saving).

Function: hex 5 output behavior



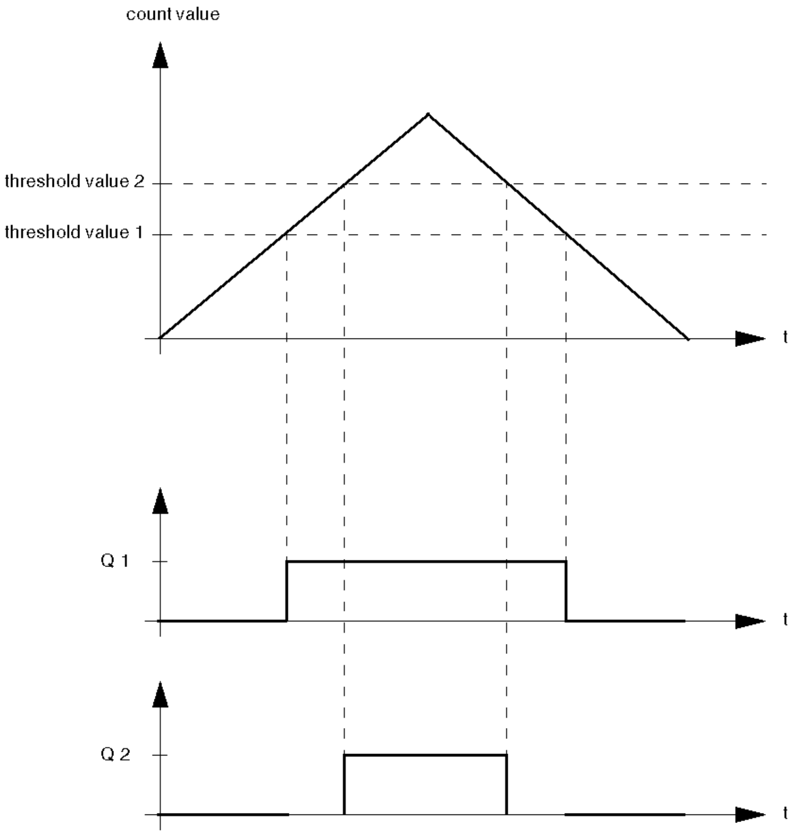
Hex 6 and Hex 8 Output Behavior

Output Q1 is set to 1 signal if the count value >= the threshold value 1. The output is set to 0 signal if the count value <= the threshold value 1.

Output Q2 is set to 1 signal if the count value >= the threshold value 2.

Output Q2 is set to 0 signal if the count value < the threshold value 2.

Function: hex 6 and hex 8 output behavior

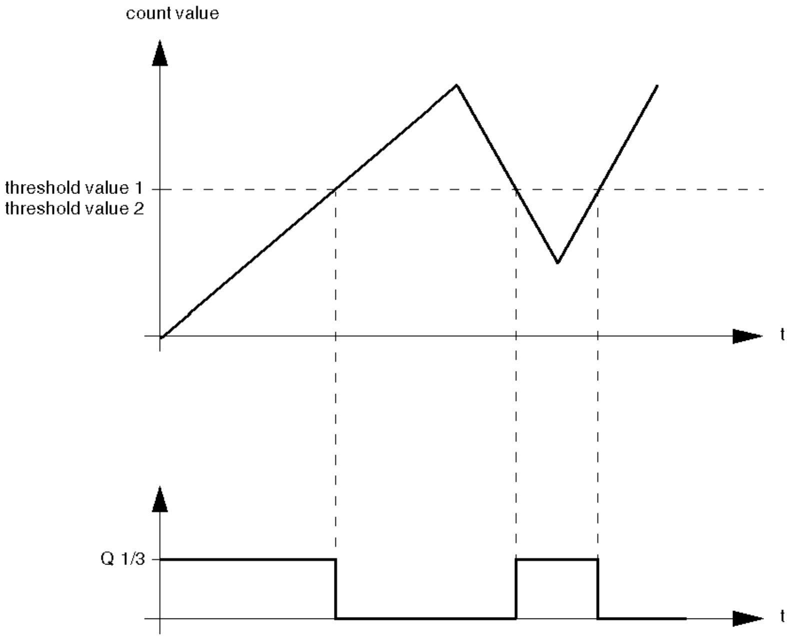


Hex 7 and Hex 9 Output Behavior

Output Q1/3 is set to 1 signal if the counter is enabled and count value < threshold value 1. The output is set to 0 signal if the count value >= the threshold value 1.

Output Q1/Q3 is set to 1 signal if the counter is enabled and count value < threshold value 2. The output is set to 0 signal if the count value >= the threshold value 2.

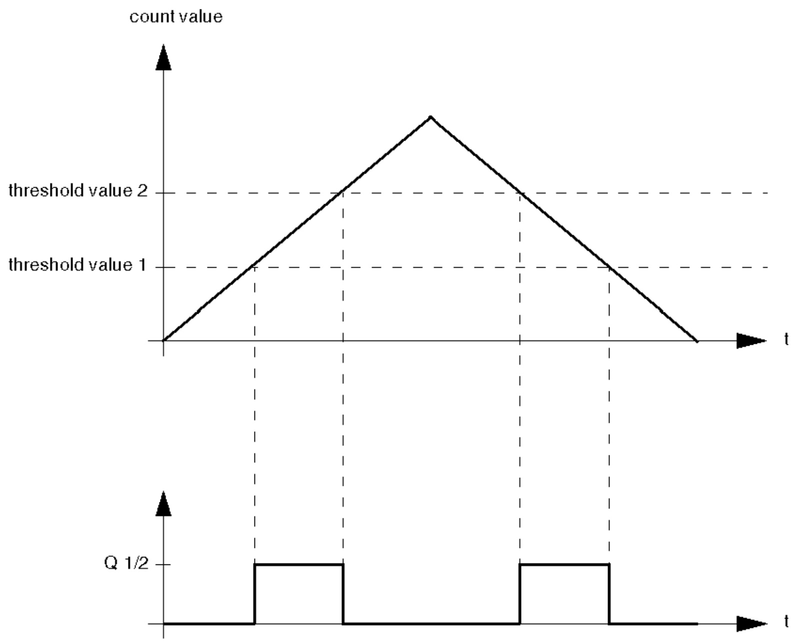
Function: hex 7 and hex 9 output behavior



Hex A Output Behavior

Output Q1/Q3 is set to 1 signal if the count value => the threshold value 1. The output Q1/Q3 is set to 0 signal if the count value => threshold value 2.

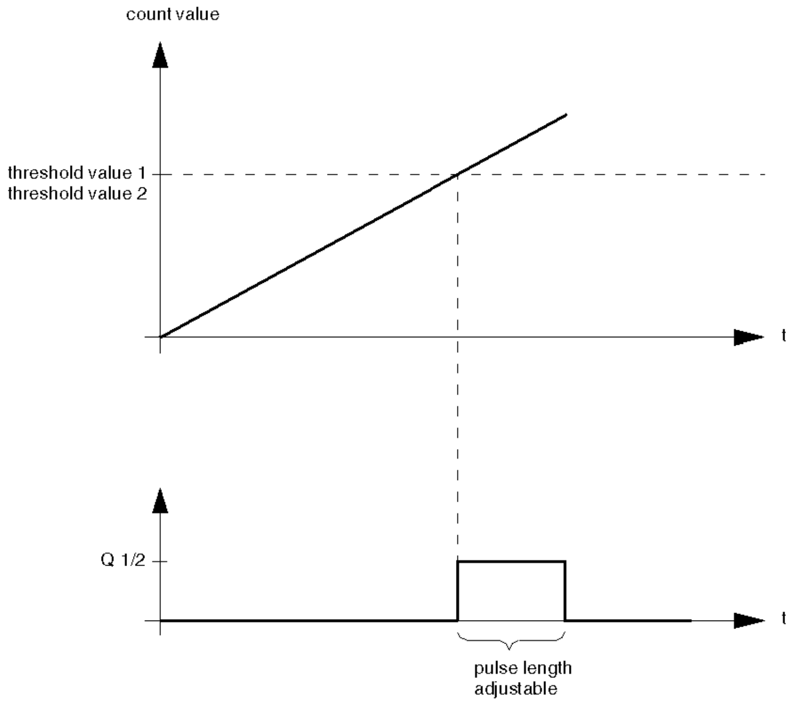
Function: hex A output behavior



Hex B and Hex C Output Behavior

The pulse is triggered as soon as the count value = threshold value 1. The pulse length can be defined here (1 … 2 EXP 32 ms).

Function: hex B and hex C output behavior



Priorities

The following priorities apply when setting the digital outputs:

highest priority	force by the PLC
	frequency output active (hex D)
	software limit switch (min., max.)
lowest priority	software configuration for threshold value 1 and 2

Data in Output Words 5/6 and 7/8

Output Words 5/6

When counter 1 matches the reference number, set points will be sent as 32-bit values in output words 5 and 6.

Reference Number	Function
hex: 0	No set point value selected
hex: 1	Preset value (24 bit + signed) or SSI offset value (max. encoder resolution)
hex: 2	Threshold value 1 (24 bit + signed for incremental encoder; 25 bit for absolute encoder)
hex: 3	Threshold value 2 (24 bit + signed for incremental encoder; 25 bit for absolute encoder)
hex: 4	Upper software-limit switch counter 1 (24 bit + signed for incremental encoder; 25 bit for absolute encoder)
hex: 5	Upper software-limit switch counter 2 (24 bit + signed for incremental encoder; 25 bit for absolute encoder)
hex: 6	Pulse width (in ms) of digital output Q1/Q2 (1 .. 2 EXP 32)
hex: 7	Modulo value for event counter (repeating counter); function can be disabled with a modulo value of 0 (max 24 bit).
hex: 8	Time base at counter operation mode **period meter** (operation mode 9) 0 = no time base Complete cycle:1 = 1 , 2 = 10, 3 = 100, 4 = 1 000, 5 = 10 000 (in micro sec.) Half period 9 = 1, A = 10, B = 100, C = 1 000, D = 10 000 (in micro sec.) Bit P_E is set for the transfer of all other values and the reference number returns to 1F.
hex: 9	Time base at counter operation mode **frequency meter** (operation mode A) 0 = no time base Complete cycle:1 = 0.1 , 2 = 1, 3 = 10, 4 = 100, 5 = 1 000 (in ms) Half period: 9 = 0.1, A = 1, B = 10, C= 100, D = 1 000 (in ms) Bit P_E is set for the transfer of all other values and the reference number returns to 1F.
hex: A	Selection of complete/half cycle for pulse counter with time base (operation mode 8) (0 = invalid, PE bit is set) 1 = complete cycle 2 = half cycle at respective count input Bx)
hex: B	Time base in ms for clock output (1 .. 2 EXP 32) only for pulses at digital outputs Q1/3 (only for half cycles)
hex: C	Reserved
hex: D to hex: F	Reserved value (corresponds to reference number 0)

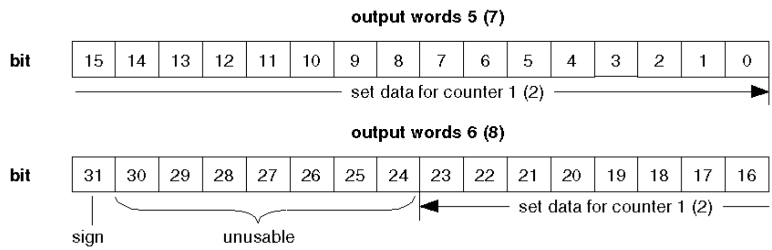
File Format of Set Data

Incremental Encoder

Set data for incremental encoder

- The resolution of the set data amounts to only 24 bits plus sign (-16 777 216 to +16 777 215)
- Modulo values only have a resolution of 24 bits without sign (0 to +16 777 215)

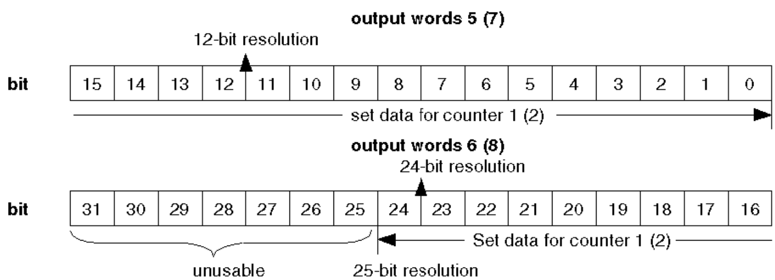
Representation of bits from output words 5(7) and 6(8)



Absolute Encoder

The resolution of the set data amounts to a maximum of 25 bits without sign (0 to +33.554.431). This is dependent on the encoder resolution (from 0 to 4 095 with 12 bits; from 0 to 16 777 215 with 24 bits).

Resolution for 12 and 24 bits



Chapter 6
Status Messages and Count Values

Overview

Status messages and count values are transferred from the counter module to the PLC in 8 words.

What Is in This Chapter?

This chapter contains the following topics:

Status and Error Bits (Words 1 and 2)

Status Bits

The counter uses the status bits to deliver error messages and states of the hardware inputs and the associated software enable information.

Status and error messages are sent to the PLC for counter 1 in input word 1.

The bits have the following meaning:

	high byte = status								low byte = error							
bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
signal	I_1	I_2	I_3	EP_B	EC_B	ECP_B	CHI_B	A_1	P_E	WD_B	L_E	SOR_E	COR_E	O_E	PS_E	M_E

Meaning of the signals

Signal	Meaning
I_1	Valence of digital input I1
I_2	Valence of digital input I2
I_3	Valence of digital input I3
EP_B	Acceptance of software releases at a preset value
EC_B	Counter 1 software releases
ECP_B	Freeze software releases with a count value of 1
CHI_B	Initialization of counter 1 complete
A_1	Valence of count input A1
P_E	Parameter error
WD_B	Time supervision error at absolute encoder
L_E	line break at the count inputs
SOR_E	Exceeded of software limit switch
COR_E	Counter overflow
O_E	Short circuit or overload of outputs Q1, Q2
PS_E	Local supply voltage missing (outputs, encoder)
M_E	Module parameters have not been defined

Error Bits (Low Bytes), Input Words 1 and 2 (Bits 0 ... 7)

The following errors are reported using these bits.

D0 = M_E

1 = Module has not yet been configured; i.e., no valid operating modes have been sent. This bit is set by resetting HW or SW.

D1 = PS_E

1 = Local supply voltage for digital outputs or sensor supply missing.

D2 = O_E

1 = A short circuit or overload has occurred at the digital outputs.

D3 = COR_E

1 = The maximum authorized count range has been exceeded. It is only possible to reset the bits using a 0->1 edge of the SW release bits (E_C). This function is not active in absolute encoder.

D4 = SOR_E

1 = The set value for the SW-limit switch has been exceeded. The digital outputs are disabled by an error message. If the count value returns within the SW-limit switch value, the SOR_E bits switches from 1 to 0 and the outputs resume their original status.

D5 = L_E

1 = A line break has occurred at counter input A, B, or Z. Only count input A is monitored by the absolute encoder.

D6 = WD_E

1 = The time supervision for sending absolute data from the encoder has responded. This error occurs as a result of a line break or inadequately set parameters for encoder resolution. It is only possible to reset the bits using a 0->1 edge of the SW release bits (E_C).

D7 = P_E

1 = Reasons for faulty parameters for counter 1 could be:

- Invalid operating mode 3,B
- The incremental encoder parameters are set for one channel and the absolute encoder for another channel.
- The wrong output configuration was selected (function E, F for output Q1/Q3; functions D, E, F for output Q2/Q4).
- In output function D for Q1/Q3, 0 was selected as the time for the frequency output.
- Invalid reference number D … 1F was selected for the set data.
- In operating mode 8 (pulse counter with external time base) no relevant mode was selected for the duration of the period (reference number A with an invalid value).
- In operating mode 9 (period meter) no valid time base was selected (reference number 8 with an invalid value).
- In operating mode A (frequency meter) no valid time base was selected (reference number 9 with an invalid value).

Status Bits (High Bytes), Input Words 1 and 2 (Bits 8 ... 15)

The following states are reported using these bits:

D8 = A_1/A_2

1 = Input count A1+A2+ (5 V) or A1*/A2* (24.V) is set to 1 signal.

D9 = CHI_B

1 = Counter has been correctly configured; i.e., both counters have been initialized for either the absolute or incremental encoder. A 0-signal indicates an incorrect operating mode or different encoder configuration.

D10 = ECP_B

1 = Enable software to freeze count value has been set.

D11 = EC_B

1 = Enable software for counters has been set.

D12 = EP_B

1 = Enable acceptance of software at preset value has been set.

D13 = I3/I6

1 = Hardware input freeze counters is set to 1-signal.

D14 = I2/I5

1 = Hardware input enable counters is set to 1-signal.

D15 = I1/I4

1 = Hardware input accept preset value is set to 1-signal.

Status Returned (Words 3 and 4)

Input Words 3 and 4

Reference numbers and the bit-parameter status of the counters are sent to the PLC in input words 3 and 4.

Return values for counter 1 are sent in input word 3.

The bits have the following meaning:

high byte = return value (bits 15 to 8)

low byte = reference numbers (bits 4 to 0)

bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
signal	RCVA	PP	ECP	ECPP	REF	free	Q2	Q1	free	free	free	Reserved	D3	D2	D1	D0

Meaning of the signals

Signal	Meaning
RCVA	1. Count cycle is complete
PP	Accept preset HW and SW values
ECP	Counter has been enabled
ECPP	Freeze HW and SW count values
REF	Preset value has been accepted (operating mode 4, 5)
free	free
Q2	Valence of digital output
Q1	Valence of digital output
free	free
free	free
free	free
Reserved	Reserved
D3	Reference numbers returned (Handshake)
D2	
D1	
D0	

Reference Number Returned (Low Bytes), Input Words 3 and 4 (Bits D0 ... D3)

Using bits (D0 … D3) reference numbers which have previously been sent to the module for configuration via output word 3/4 are reported back to the PLC. A returned reference number serves as a handshake for sent set data. See Reference Numbers for Set Data (Output Words 3 and 4 (Bits 0 ... 4) *(see page 75)*.

NOTE: Should an invalid reference number be sent, it will be recorded in these bits (D0 ... D4) with a value of 1F hex, and the set data in words 5/6 and 7/8 will not be accepted.

Status Returned (High Bytes), Input Words 3 and 4 (Bits 8 ... 15)

Using bits (D0 … D15) the status of the counter module and the output are returned.

Bit	Signal	Meaning
D8	Q1/Q3	1 = Digital output Q1/Q3 has a 1-signal.
D9	Q2/Q4	1 = Digital output Q2/Q4 has a 1-signal.
D10	not used	
D11	REF	1 = The preset value has been accepted (Mode 4 or 5) and the outputs have been enabled. In all other operating modes no presetting is necessary to enable the outputs. 0 = The preset value has not been accepted (Mode 4 or 5) and the outputs have not been enabled, or an invalid operating mode was selected.
D12	ECPP	1 = The function freeze count values has been activated.
D13	ECP	1 = The function enable counters has been activated.
D14	PP	1 = The function accept preset value is performed by the counters.
D15	RCVA	1 = The first count cycle in operating modes 8 (pulse counter), 9 (period measurement) or A (frequency measurement) is complete.

Actual Values for Counters 1 and 2

Input Words 5, 6 and 7, 8

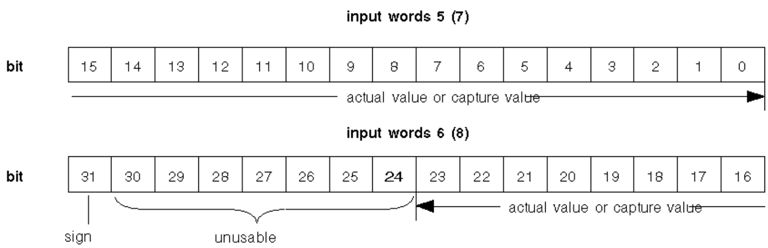
The current encoder values (actual data) are placed in input words 5 and 6 (for counter 1), or 7 and 8 (for counter 2). Therefore, each counter has two words (1 double word) at its disposal.

NOTE: Only the counters' feedback data is sent in input words 5/6 or 7/8. It is not possible to review previously sent set data.
The parameter values are not sent back to the bus adapter.

Current Values for the Incremental Encoder

Resolution with/without sign:
- The resolution of the feedback data amounts to only 24 bits plus sign (-16.777.216 to +16 777 215).
- If a modulo value is entered, the resolution amounts to a maximum of 24 bits without sign (0 to +16 777 215).

Representation of actual values

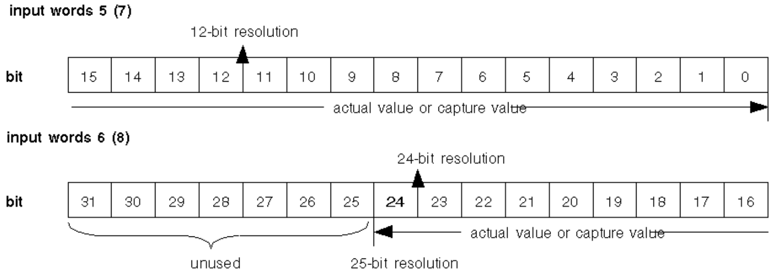


Current Values for the Absolute Encoder

Absolute encoders constantly report current values. The resolution is:

- for 25 cycles – 25 bits without sign, i.e. from 0 to 33 554 431
- for 24 cycles -24 bits without sign, i.e. from 0 to 16.777.215
- for 12 cycles -12 bits without sign, i.e. from 0 to 4.095

Representation of input words for 12, 24 and 25 bits:



Chapter 7
Parameter Setting of the AEC Block

Overview

This chapter describes the AEC block.

What Is in This Chapter?

This chapter contains the following topics:

Configuring Channels on the 170 AEC 920 00 Counter Module

Using the AEC Function Block

Use the AEC derived function block (DFB) to configure the 170 AEC 920 00 module in Control Expert program logic. Each counter channel requires a separate AEC DFB.

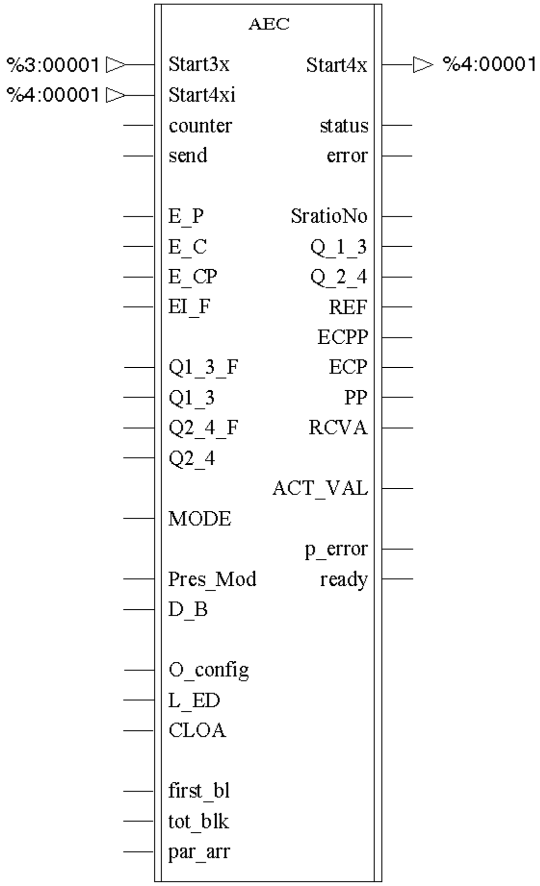
NOTE: The 170 AEC 920 00 module DFB is not part of the standard EF/DFB library. To obtain this DFB, you can download it from Schneider Electric Technical Support at http://eclipse.modicon.com.

Each AEC DFB transmits many set values, one after another, which are then stored in the data structure `par_arr`, and returns the current values of the counters. The data transfer of bytes, words, and double words is started using a 0 -> 1 edge at the send input. All bits are sent in each scan cycle.

NOTE: If you include a 170 AEC 920 00 module in your configuration, the module configuration is written to and stored in the first 2 words of %MW memory (%MW1 and %MW2). You may need to reassign the memory locations of variables in your application program to avoid memory conflicts.

AEC DFB Structure

The AEC DFB presents the following structure:



Inputs

Each AEC DFB presents the following outputs:

Parameters	Data Type	Meaning
Start3x	Word Arr 9	1. Address of the 8 input words
Start4xi	Word Arr 9	1. Address of the 8 output words
Counter	Byte	Select counter 1 or 2
send	BOOL	0-1 Edge for the data transfer of byte, word, double word (BOOL values are sent in a cyclic manner)
E_P	BOOL	Enable acceptance of preset value
E_C	BOOL	Software Enable for counter
E_CP	BOOL	Software Enable to freeze counter value
EI_F	BOOL	Enable input filter
Q1_3_F	BOOL	Activate forcing of digital outputs Q1/3
Q1_3	BOOL	Record Valence of digital outputs Q1/3;
Q2_4_F	BOOL	Activate forcing of digital outputs Q2/4;
Q2_4	BOOL	Record Valence of digital outputs Q2/4;
Mode	Byte	4 bits for the choice of operation mode
Pres_Mod	Byte	3 bits for the choice of preset mode
D_B	BOOL	Invert counting direction; effective in all operating modes
O_config	Byte	Configure outputs Q1/2 or Q3/4
L_ED	BOOL	Monitoring of the counter inputs A, B, Z for a line break.
CLOA	BOOL	Behavior of Q1 to Q4 during bus interruption
first_bl	INT	Number of the first data block to be sent
tot_blk	INT	Total number of data blocks to be sent
par_arr	Word Arr 31	Data structure with 31 word data block: 1. word: Reference number 2. word: Set point value (High word) 3. word: Set point value (low word)

NOTE: The data structure *par_arr* is comprised of 10 blocks.. Each data block has 3 words, the reference number, the setpoint value (low word), and the setpoint value (high word).

Outputs

Each AEC DFB presents the following outputs:

Parameters	Data Type	Meaning
Start4x	Word Arr 9	1. Address of the 8 output words
status	Byte	High-byte of 1st or 2nd input word (Status bits)
error	Byte	Low-byte of 1st or 2nd input word (detected error bits)
SratioNo	Byte	Reference number returned (if detected error = 1 F hex)
Q_1_3	BOOL	Valence of output Q1 or Q3
Q_2_4	BOOL	Valence of output Q2 or Q4
REF	BOOL	Preset value has been accepted
ECPP	BOOL	Freeze HW and SW counter values
ECP	BOOL	Counter has been enabled
PP	BOOL	Accept preset HW and SW values
RCVA	BOOL	1. Count cycle is complete
ACT_VAL	DINT	Current value or capture value
p_error	BOOL	Detected transmission error (wrong value)
ready	BOOL	Data transfer display: 0 = Transmission is active 1 = Transmission is complete

Brief Description

Using the AEC Function Block

Use the AEC derived function block (DFB) to configure the 170 AEC 920 00 module in Control Expert program logic. Each counter channel requires a separate AEC DFB.

NOTE: The 170 AEC 920 00 module DFB is not part of the standard EF/DFB library. To obtain this DFB, you can download it from Schneider Electric Technical Support at http://eclipse.modicon.com.

Each AEC DFB transmits many set values, one after another, which are then stored in the data structure `par_arr`, and returns the current values of the counters. The data transfer of bytes, words, and double words is started using a 0 -> 1 edge at the send input. All bits are sent in each scan cycle.

NOTE: If you include a 170 AEC 920 00 module in your configuration, the module configuration is written to and stored in the first 2 words of %MW memory (%MW1 and %MW2). You may need to reassign the memory locations of variables in your application program to avoid memory conflicts.

Chapter 8
Application Examples

Overview

The following chapter contains typical applications, outlining configuration and associated wiring.

What Is in This Chapter?

This chapter contains the following sections:

Section 8.1
Up Counter (Mode 2)

Overview

This section described the application of the 170 AEC 920 00 counter module as an up counter in mode 2 with a 24 V impulse encoder.

What Is in This Section?

This section contains the following topics:

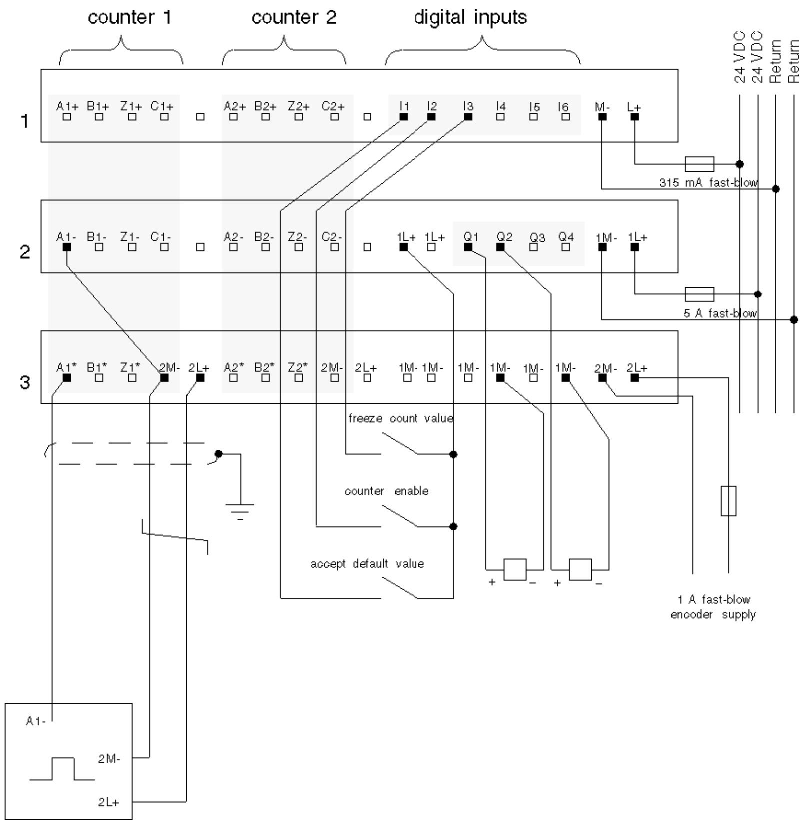
Example 1

Up Counter with 24 V Impulse Encoder (Mode 2)

Task specification: counter 1 as up counter

- Counter enabling via hardware input 2.
- Reset via hardware input 1 (0–>1–edge).
- Start value of the counter is 0.
- Threshold value 1 is 100.
- Threshold value 2 is 200.
- Output 1 turns on when the counter is enabled and turns off when the threshold value 1 is reached.
- Output 2 turns on when threshold value 1 is reached and turns off when threshold value 2 is reached.

Installation example for pulse encoder (24 V)



Solution

Setting Parameters

The counter parameters are set in 5 steps:

1. setting the operating mode and preset mode
2. sending the threshold value 1, configuring output 1
3. sending the threshold value 2, configuring output 2
4. setting the software enable
5. setting the hardware enable

These steps are explained below.

Step 1: Setting the Operating Mode and Preset Mode

The operating mode (=2) and the preset mode (=1) are set. This is done via output word 1.

Output word

Output Word	Entry
400 101	1200 hex
400 102	0
400 103	0
400 104	0
400 105	0
400 106	0
400 107	0
400 108	0

Input word

Input Word	Return value
300 101	220 hex
300 102	
300 103	800 hex
300 104	
300 105	
300 106	
300 107	
300 108	

Step 2: Sending the Threshold Value 1, Configuring Output 1

The threshold value 1 = 100 is sent. Output 1 is simultaneously configured (reference number 7), and the line break detection is turned off. Output words 3 and 5 are also used for this. All the other entries remain.

Output word

Output Word	Entry
400 101	1200 hex
400 102	0
400 103	782 hex
400 104	0
400 105	100 hex
400 106	0
400 107	0
400 108	0

Input word

Input Word	Return Value
300 101	200 hex
300 102	
300 103	802 hex
300 104	
300 105	
300 106	
300 107	
300 108	

Step 3: Sending the Threshold Value 2, Configuring Output 2

The threshold value 2 = 200 is sent. Output 2 is simultaneously configured (reference number A) Output words 3 and 5 are also used. All the other entries remain.

NOTE: Modify the contents of word 400103 and the entry in word 400105. Otherwise, you would overwrite the value for threshold value 1.

Output word

Output Word	Entry
400 101	1200 hex
400 102	0
400 103	A783 hex
400 104	0
400 105	200 hex
400 106	0
400 107	0
400 108	0

Input word

Input Word	Return Value
300 101	200 hex
300 102	
300 103	803 hex
300 104	
300 105	
300 106	
300 107	
300 108	

Step 4: Setting the Software Enable

The counter's software enable is now set. This occurs in output word 1. All the other entries remain.

Output word

Output Word	Entry
400 101	1203 hex
400 102	0
400 103	A783 hex
400 104	0
400 105	200 hex
400 106	0
400 107	0
400 108	0

Input word

Input Word	Return Value
300 101	5A00 hex
300 102	
300 103	803 hex
300 104	
300 105	
300 106	
300 107	
300 108	

Step 5: Hardware Enable

Enable the counter by setting binary input 2.

Output 1 is now active. Every pulse at counter input 1 is counted The current count value is in register word 300 105. The counter can be reset to 0 by a 0–>1– edge at digital input 1 (preset value = 0).

Section 8.2
Up Counter with Preset Value

Overview

This section described the application of the 170 AEC 920 00 counter module as an up counter with a 24 V pulse encoder and preset values.

What Is in This Section?

This section contains the following topics:

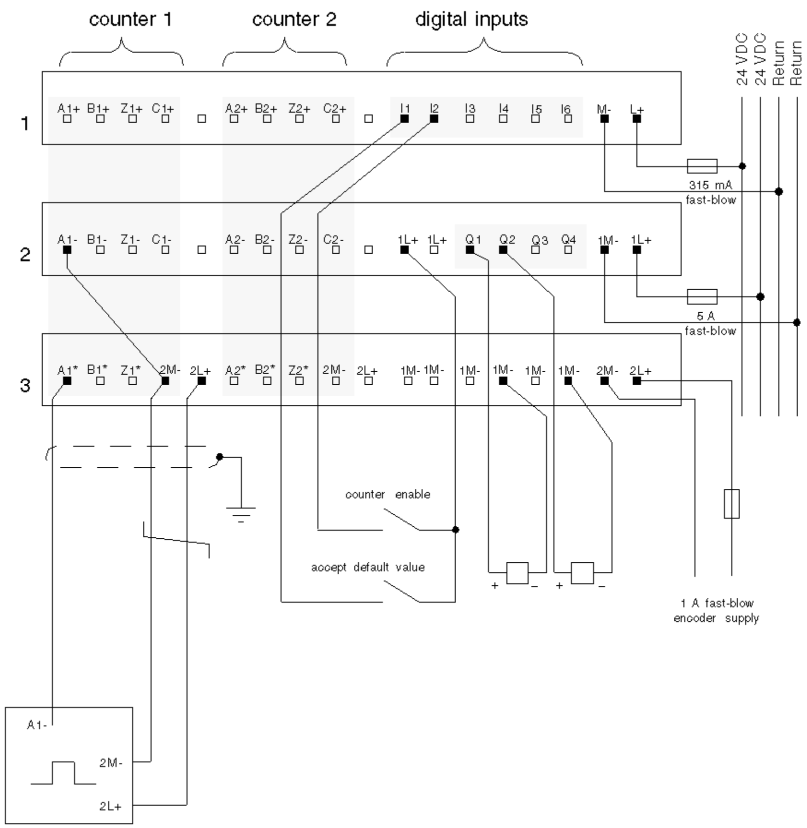
Task Specification

Up Counter with 24 Volt Pulse Encoder and Preset Value

Task specification:

- Counter 1 as up counter with preset value.
- Counter enabling via hardware input 2.
- Reset via hardware input 1 (0–>1–edge).
- Start value of the counter is 100.
- Threshold value 1 is 200.
- Threshold value 2 is 300.
- Output 2 turns on when threshold value 1 is reached and turns off when threshold value 2 is reached.
- Output 1 remains unused.

Wiring example for up counter with pulse encoder (24 V)



Solution

Setting Parameters

The parameters for the counter are set in 7 steps:

1. setting the operating mode and preset mode
2. sending the preset value
3. sending the threshold value 1, configuring output 2
4. sending the threshold value 2
5. setting the software enable
6. setting the counter to the preset value
7. setting the hardware enable

These steps are explained below.

Step 1: Setting the Operating Mode and Preset Mode

The operating mode (=2) and the preset mode (=1) are set. This is done via output word 1.

Output word

Output Word	Entry
400 101	1200 hex
400 102	0
400 103	0
400 104	0
400 105	0
400 106	0
400 107	0
400 108	0

Input word

Input Word	Return Value
300 101	220 hex
300 102	
300 103	800 hex
300 104	
300 105	
300 106	
300 107	
300 108	

Step 2: Sending the Preset Value

The preset value 100 is sent. Output words 3 and 5 are also used for this. All the other entries remain.

Output word

Output Word	Entry
400 101	1200 hex
400 102	0
400 103	81 hex
400 104	0
400 105	100 dec
400 106	0
400 107	0
400 108	0

Input word

Input Word	Return Value
300 101	200 hex
300 102	
300 103	801 hex
300 104	
300 105	
300 106	
300 107	
300 108	

NOTE: Steps 1 and 2 can also be combined into one.

Step 3: Sending the Threshold Value 1, Configuring Output 2

Send the threshold value 1 = 200. Output 2 is configured at the same time (reference number A). Output words 3 and 5 are also used for this. All the other entries remain.

Output word

Output Word	Entry
400 101	1200 hex
400 102	0
400 103	A082 hex
400 104	0
400 105	200 dec
400 106	0
400 107	0
400 108	0

Input word

Input Word	Return Value
300 101	200 hex
300 102	
300 103	802 hex
300 104	
300 105	
300 106	
300 107	
300 108	

Step 4: Sending the Threshold Value 2

Send the threshold value 2 = 300. Output registers 3 and 5 are used again. All the other entries remain.

NOTE: Modify the contents of word 400103 and then the entry in word 400105. Otherwise, you would overwrite the value for threshold value 1.

Output word

Output Word	Entry
400 101	1200 hex
400 102	0
400 103	A083 hex
400 104	0
400 105	300 dec
400 106	0
400 107	0
400 108	0

Input word

Input Word	Return Value
300 101	200 hex
300 102	
300 103	803 hex
300 104	
300 105	
300 106	
300 107	
300 108	

Step 5: Setting the Software Enable

Set the software enable. This occurs in output word 1. All the other entries remain.

Output word

Output Word	Entry
400 101	1203 hex
400 102	0
400 103	A083 hex
400 104	0
400 105	300 dec
400 106	0
400 107	0
400 108	0

Input word

Input Word	Return Value
300 101	1A00 hex
300 102	
300 103	803 hex
300 104	
300 105	
300 106	
300 107	
300 108	

Step 6: Setting the Counter to the Preset Value

Set the counter status to the preset value. Then, trigger a 0–>1–edge at the binary entry. Now the entry register 300 105 displays this value.

Output word

Output Word	Entry
400 101	1203 hex
400 102	0
400 103	A003 hex
400 104	0
400 105	300 dec
400 106	0
400 107	0
400 108	0

Input word

Input Word	Return Value
300 101	9A00 hex
300 102	
300 103	4803 hex
300 104	
300 105	100 dec
300 106	
300 107	
300 108	

Step 7: Hardware Enable

Enable the counter by setting binary input 2.

Each pulse at the count input 1 is counted as long as the binary input 1 has a 1 signal. Register word 300 105 displays the current count value. Output 2 becomes active when the counter value is between threshold values 1 and 2; output 1 always remains inactive.

The counter is reset to the preset value with a 0–>1–edge at digital input 1.

NOTE: To set a new preset value or another kind of presetting, the new value must be sent and then a positive edge must be triggered on the software bit E_P (bit 0 in the first output word). New set points are accepted directly.

Section 8.3
Up Counter with Internal Clock Pulse

Overview

This section describes the application of the 170 AEC 920 00 counter module as an up counter with a 24 V pulse encoder and internal clock pulse.

What Is in This Section?

This section contains the following topics:

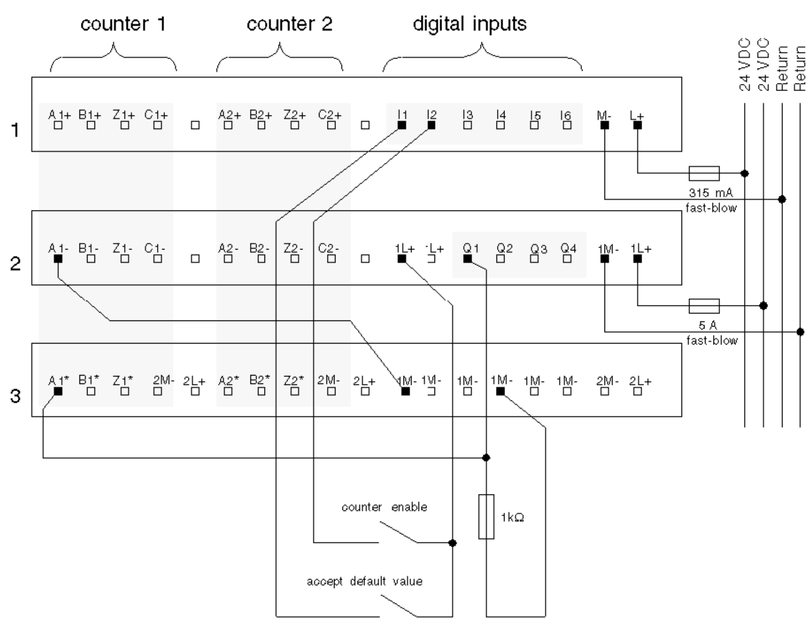
Task Specification

Up Counter with 24 Volt Pulse Encoder and Internal Clock Pulse

Task specification

- Counter 1 as up counter.
- Counter enabling via hardware input 2.
- Reset via hardware input 1 (0–>1–edge).
- Start value of the counter is 100.
- Threshold value 1 is 200.
- Threshold value 2 is 300.
- Output 1 is frequency output with 250ms pulse. These cycles are to be counted.
- Output 2 turns on when threshold value 1 is reached and turns off when threshold value 2 is reached.
- (Output 1 remains unused).

Wiring diagram for up counter with 24 Volt pulses and internal clock



Solution

Setting Parameters

The counter parameters are set in 7 steps:

1. setting the operating mode and preset mode, sending the preset value
2. configuring output 1 as a frequency output
3. sending the threshold value 1, configuring output 2
4. sending the threshold value 2
5. setting the software enable
6. setting the counter to the preset value
7. setting the hardware enable

These steps are explained below.

Step 1: Setting the Operating Mode and Preset Mode, Sending the Preset Value

Set the operating mode (=2) and the preset mode (=1). At the same time, send the preset value 100 (reference number 1). Output registers 1, 3 and 5 are also used.

Step 1: Setting the Operating Mode and Preset Mode

Output word

Output Word	Entry
400 101	1200 hex
400 102	0
400 103	81 hex
400 104	0
400 105	100 dec
400 106	0
400 107	0
400 108	0

Input word

Input Word	Return Value
300 101	200 hex
300 102	
300 103	801 hex
300 104	
300 105	
300 106	
300 107	
300 108	

Step 2: Configuring Output 1 as a Frequency Output

Configure output 1 as a frequency output (output mode D) and send the time base 250ms for the cycle frequency (output registers 3 and 5). The output then flashes at 250ms intervals.

Output word

Output Word	Entry
400 101	1200 hex
400 102	0
400 103	D8B hex
400 104	0
400 105	250 dec
400 106	0
400 107	0
400 108	0

Input word

Input Word	Return Value
300 101	200 hex / 300 hex
300 102	
300 103	80B hex / 90B hex
300 104	
300 105	
300 106	
300 107	
300 108	

Step 3: Sending the Threshold Value 1, Configuring Output 2

Configure the output 2 (output mode A) and send the threshold value 1 = 200 (output registers 3 and 5).

Output word

Output Word	Entry
400 101	1200 hex
400 102	0
400 103	AD82 hex
400 104	0
400 105	200 dec
400 106	0
400 107	0
400 108	0

Input word

Input Word	Return Value
300 101	200 hex / 300 hex
300 102	
300 103	802 hex / 902 hex
300 104	
300 105	
300 106	
300 107	
300 108	

Step 4: Sending the Threshold Value 2

Send the threshold value 2 = 300 (output registers 3 and 5).

NOTE: Modify the contents of register 400103 before the entry in register 400105. Otherwise, overwrite the value for threshold value 1.

Output word

Output Word	Entry
400 101	1200 hex
400 102	0
400 103	AD83 hex
400 104	0
400 105	300 dec
400 106	0
400 107	0
400 108	0

Input word

Input Word	Return Value
300 101	200 hex / 300 hex
300 102	
300 103	803 hex / 903 hex
300 104	
300 105	
300 106	
300 107	
300 108	

Step 5: Setting the Software Enable

Set the software enable (output word 1).

Output word

Output Word	Entry
400 101	1203 hex
400 102	0
400 103	AD83 hex
400 104	0
400 105	300 dec
400 106	0
400 107	0
400 108	0

Input word

Input Word	Return Value
300 101	1B00 hex / 1A00 hex
300 102	
300 103	803 hex / 903 hex
300 104	
300 105	
300 106	
300 107	
300 108	

Step 6: Setting the Counter to the Preset Value

Set the counter status to the preset value. Then, trigger a 0–>1–edge at the binary entry. Now the entry register 300 105 displays this value.

Output word

Output Word	Entry
400 101	1203 hex
400 102	0
400 103	AD83 hex
400 104	0
400 105	300 dec
400 106	0
400 107	0
400 108	0

Input word

Input Word	Return Value
300 101	9B00 hex / 4903 hex
300 102	
300 103	4803 hex / 4903 hex
300 104	
300 105	100 dec
300 106	
300 107	
300 108	

Step 7: Hardware Enable

Enable the counter by setting binary input 2.

Each pulse at the count input 1 is counted as long as 1 signal is at binary input 1. Register word 300 105 displays the current count value. Output 2 becomes active when the counter value is between threshold values 1 and 2; output 1 always remains inactive.

The counter is reset to the preset value with a 0–>1–edge at digital input 1.

NOTE: When configuring output 1 or 3 as a frequency output, make sure that a value > 0 is entered in register 5/6 or 7/8 before mode D (register 3 or 4) is entered for the corresponding output, otherwise the output remains inactive.

Inverting bit D_B (bit 15 in output word 1) reverses the counting direction.

Section 8.4
Pulse Counter with External Time Base

Overview

This section describes the application of the 170 AEC 920 00 counter module as a pulse counter (mode 8) with an external time base.

What Is in This Section?

This section contains the following topics:

Example 4

Pulse Counter (Mode 8) with External Time Base

Task specification

The number of pulses per time interval is to be counted. This time interval need not be fixed but can vary. In this example, it is one second. The pulses to be counted are on digital output 1 and the counting gate on digital output 3.

This results in the following settings:
- operating mode 8
- counter 1 as pulse counter, complete period
- Output 1 is a frequency output with e.g. a 5 ms cycle (5 ms in, 5 ms out) and simulates the counter pulse.
- Output 3 is a frequency output with a 500 ms cycle (500 ms in, 500 ms). It simulates the time base of 1s with the "complete period" setting. (Counting then proceeds from one positive edge to the next.)

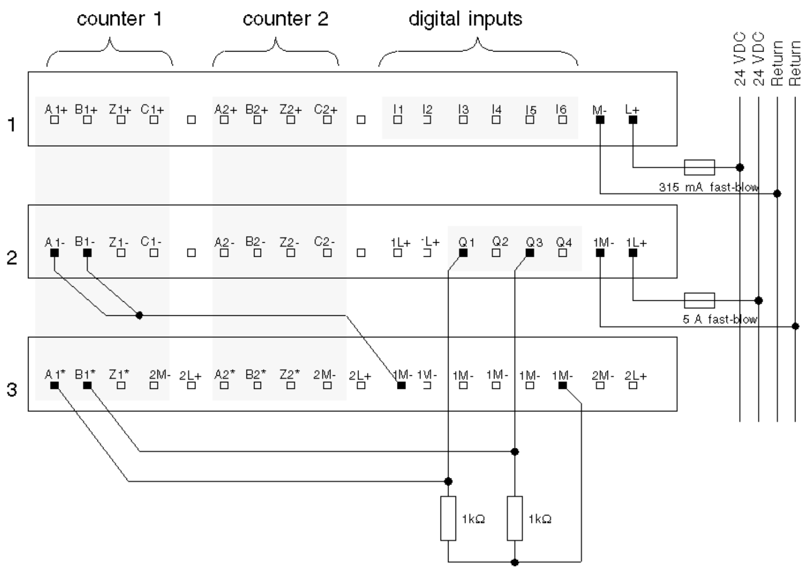
NOTE: In pulse counter mode, the preset mode and the digital inputs have no function. Only the frequency output function is available for the digital outputs. 24 single ended signals are present in this example. Therefore, only the 20 kHz filter needs to be activated.

Wiring Example for Pulse Counter

Wire:

- output 1 with count input A1* (clamp 2.13 with clamp 3.1)
- output 3 with count input A1* (clamp 2.15 with clamp 3.2)
- A1 with the group of digital outputs (clamp 2.1 with clamp 3.,11)
- B1- and the group of digital outputs (clamp 2.2 with clamp 3.12)
- each 1 kOhm of resistance from output 1 and 3 to the group

Example of wiring for pulse counter (complete period) with external time base



Solution

Setting Parameters

The counter parameters are set in these 5 steps:

1. setting the operating mode and activating the 20 kHz filter
2. configuring output 1 as a frequency output for the count frequency and disabling the line break monitoring
3. configuring output 3 as a frequency output for the time base
4. sending the complete period id
5. setting the software enable

These steps are explained below.

Step 1: Setting the Operating Mode and Activating the 20 kHz Filter

Set the operating mode (=8) and the 20 kHz filter. This occurs in the output word word 1.

Output word

Output Word	Entry
400 101	808 hex
400 102	0
400 103	0
400 104	0
400 105	0
400 106	0
400 107	0
400 108	0

Input word

Input Word	Return Value
300 101	220 hex
300 102	
300 103	800 hex
300 104	
300 105	
300 106	
300 107	
300 108	

Step 2: Configuring Output 1 as a Frequency Output and Disabling the Line Break Monitoring

Configure output 1 as a frequency output (output mode D), disable the line break monitoring and send the time base 5ms as the cycle frequency (output registers 3 and 5). The output then flashes at 5ms intervals.

NOTE: Enter the time base first and then the reference values in register 3. Otherwise, output 1 is disabled.

Output word

Output Word	Entry
400 101	808 hex
400 102	0
400 103	D8B hex
400 104	0
400 105	5 dec
400 106	0
400 107	0
400 108	0

Input word

Input Word	Return Value
300 101	200 hex / 300 hex
300 102	
300 103	80B hex / 90B hex
300 104	
300 105	
300 106	
300 107	
300 108	

Step 3: Configuring Output 3 (Counter 2) as a Frequency Output for the Time Base

Configure output 3 as a frequency output (output mode D) and send a cycle frequency time base of 500ms (output registers 4 and 7). The output then flashes at 500ms intervals.

Output word

Output Word	Entry
400 101	808 hex
400 102	0
400 103	D8B hex
400 104	D0B hex
400 105	5 dec
400 106	0
400 107	500 dec
400 108	0

Input word

Input Word	Return Value
300 101	200 hex / 300 hex
300 102	
300 103	80B hex / 90B hex
300 104	B hex / 10B hex
300 105	
300 106	
300 107	
300 108	

NOTE: Steps 1 ... 3 can also be combined into one.

Step 4: Sending the Complete Period ID

This occurs via output registers 3 and 5 (reference number A, value 1).

Output word

Output Word	Entry
400 101	808 hex
400 102	0
400 103	D8A hex
400 104	D0B hex
400 105	1 dec
400 106	0
400 107	500 dec
400 108	0

Input word

Input Word	Return Value
300 101	200 hex / 300 hex
300 102	
300 103	80A hex / 90A hex
300 104	B hex / 10B hex
300 105	
300 106	
300 107	
300 108	

Step 5: Setting the Software Enable

Set the counter enable (bit in register 1).

Output word

Output Word	Entry
400 101	80A hex
400 102	0
400 103	D8A hex
400 104	D0B hex
400 105	1 dec
400 106	0
400 107	500 dec
400 108	0

Input word

Input Word	Return Value
300 101	A00 hex / B00 hex
300 102	
300 103	880A hex / 890A hex
300 104	B hex / 10B hex
300 105	100 dec
300 106	
300 107	
300 108	

The pulse at count input 1 are counted as long as the software enable is on. After the first measurement, bit 15 in input register 3 is set and the count value per second is in input register 5, 100 in this case.

NOTE: When configuring output 1 or 3 as a frequency output, make sure that a value > 0 is entered in register 5/6 or 7/8 before mode D (register 3 or 4) is entered for the corresponding output; otherwise, the output remains inactive.

Switching from full to half cycle only becomes active after a positive edge of the software enable bit (bit 1 in word 1).

The digital inputs have no function in operating mode 8.

Section 8.5
Period Meter with Internal Time Base

Overview

This section describes the application of the 170 AEC 920 00 counter module as a period meter with an internal time base.

What Is in This Section?

This section contains the following topics:

Task Specification

Period Meter (Mode 9) with External Time Base

In this operating mode the duration of a period can be measured. This period is the duration of a
- positive edge to the next negative one at count input A (= counting gate)half cycle
- positive to the next positive edge at count input A (= counting gate) full cycle

During the gate opening time the counter counts internal time cycles that it generates according to a definable time base. This time base is entered as a coded value that also specifies whether the counting gate is opened over the full or half cycle. Five different time bases with a full and half cycle respectively are available – 10 different codes altogether.

The time base (internally generated time interval) should be 10ms. The period to be measured is simulated via digital output 3 (frequency output with a 50ms time interval).

The following settings are generated from this:
- operating mode 9 (counter 1 as period meter)
- time base 2 (10 ms, full cycle)
- Output 3 is a frequency output with a 50 ms interval and generates the counting gate (50ms in, 50ms out = 100ms gate opening time in a full cycle).

NOTE: In period meter mode, the preset mode and the digital inputs have no function. Only the frequency output function is available for the digital outputs.

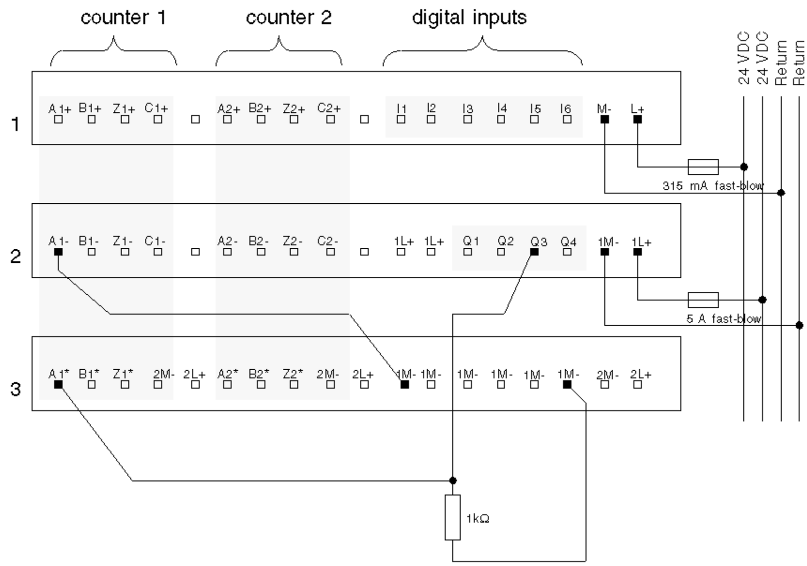
24 single-ended signals are present in this example. Therefore, only the 20 kHz filter needs to be activated.

As no signals are connected to counter input B and Z, the line break monitoring needs to be disabled.

Wiring:

- output 3 with count input A1* (clamp 2.15 with clamp 3.1)
- A1 with the group of digital outputs (clamp 2.1 with clamp 3.11)
- A 1 kOhm resistance from output 1 to the group

Example of wiring for period meter (mode 9) with internal time base



Solution

Setting Parameters

The counter parameters are set in these 4 steps:

1. setting the operating mode and activating the 20 kHz filter
2. configuring output 3 as a frequency output for the count frequency
3. sending the time base, period id and disabling the line break monitoring
4. setting the software enable 1

These steps are explained below.

Step 1: Setting the Operating Mode and Activating the 20 kHz Filter

Set the operating mode (=9) and the 20 kHz filter. This occurs in the output word word 1.

Output word

Output Word	Entry
400 101	908 hex
400 102	0
400 103	0
400 104	0
400 105	0
400 106	0
400 107	0
400 108	0

Input word

Input Word	Return Value
300 101	220 hex
300 102	
300 103	800 hex
300 104	
300 105	
300 106	
300 107	
300 108	

Step 2: Configuring Output 3 (Counter 2) as a Frequency Output for the Count Pulse

Configure output 3 as a frequency output (output mode D) and send a time base of 50ms for the cycle frequency (output words 4 and 7). The output then flashes at 50ms intervals.

NOTE: Enter the time base into register 7 first, then the reference numbers D0B into register 4. Otherwise, output 3 will be disabled.

Output word

Output Word	Entry
400 101	908 hex
400 102	0
400 103	0
400 104	D0B hex
400 105	0
400 106	0
400 107	50 dec
400 108	0

Input word

Input Word	Return Value
300 101	220 hex / 320 hex
300 102	
300 103	800 hex
300 104	B hex / 10B hex
300 105	
300 106	
300 107	
300 108	

Step 3: Sending the Time Base, Period ID, and Disabling the Line Break Monitoring

This is done via output words 3 and 5.

Output word

Output Word	Entry
400 101	908 hex
400 102	0
400 103	88 hex
400 104	D0B hex
400 105	2 dec
400 106	0
400 107	50 dec
400 108	0

Input word

Input Word	Return Value
300 101	200 hex / 300 hex
300 102	
300 103	808 hex
300 104	B hex / 10B hex
300 105	
300 106	
300 107	
300 108	

Step 4: Setting the Software Enable

Set the counter enable (bit in word 1).

Output word

Output Word	Entry
400 101	90A hex
400 102	0
400 103	88 hex
400 104	D0B hex
400 105	2 dec
400 106	0
400 107	50 dec
400 108	0

Input word

Input Word	Return Value
300 101	A00 hex / B00 hex
300 102	
300 103	8808 hex
300 104	B hex / 10B hex
300 105	9990 dec
300 106	
300 107	
300 108	

NOTE: Steps 1 ... 4 can also be combined into one.

The internal time interval encoder pulse are counted as long as the counting gate is open and the software enable is present. After the first measurement, bit 15 in input word 3 is set and the count value per gate opening time is in input word 5, 9990 in this case. This corresponds to 9990 x 10ms = 99.9ms.

Index

A

B

C

E

F

I

M

P

S

T

W