FACTORY AUTOMATION

Instruction Manual

Ethernet-Absolute-Encoders with TCP/IP-Protocol

PEPPERL+FUCHS

Date of issue: 05/12/2005

General Information

Note

This symbol advises the user of important tips.

Safety Instructions

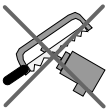
Warning

Please observe the national safety and accident prevention regulations as well as the subsequent safety instructions in these operating instructions when working on encoders.
If failures cannot be remedied, the device has to be shut down and has to be secured against accidental operation.
Repairs may be carried out only by the manufacturer.
Entry into and modifications of the device are not permissible.

Caution

Tighten the clamping ring only, if a shaft has been fitted in the area of the clamping ring (hollow shaft encoders).
Tighten all screws and plug connectors prior to operating the encoder.

Do not stand on the encoder!



Do not remachine the drive shaft!

Avoid impact!

Do not remachine the housing!

Pepperl+Fuchs GmbH, in D-68301 Mannheim, has a certified quality assurance program in accordance with ISO 9001.

CE

ISO**9001**

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1 Introduction

1.1 Absolute Rotary Encoders

Absolute rotary encoders provide a definite value for every possible rotary position. All these values are reflected on one or more code discs. The beams of infrared LEDs are sent through the code discs and detected by Opto-Arrays. The output signals are electronically amplified and the resulting value is transferred to the interface.

The absolute rotary encoder has a maximum resolution of 65,536 steps per revolution (16 bit). The multiturn version can detect up to 16,384 revolutions (14 bit). Therefore the largest resulting resolution is 30 bit = 1,073,741,824 steps. The standard singleturn version has 13 bit, the standard multiturn version 25 bit.

The encoder sends the data in decimal code via standard or fast Ethernet (10 Base T, 100 Base T). At present it supports the following international standardized protocols: IP, TCP, UDP, http and SMTP.

The encoder is able to provide three different kinds of output data:

- the position value
- a velocity value
- a time stamp.

These can be used in arbitrary combinations.

The following functions of the absolute rotary encoder can be programmed directly via the Ethernet connection:

- Used scope of physical resolution
- Total scaled resolution
- Preset value
- Code sequence (Complement)

There is no specific software required to initiate and use the absolute rotary encoder because the sensor can be read out and programmed by any standard web browser. For this purpose the absolute rotary encoder contains a web server, which provides HTML documents with embedded Java applets. These documents are a widely self-explanatory graphical user interface (GUI) that is described in detail in chapter 3. The automated data transfer with a control system is done with TCP/IP by simple plain text commands and data in ASCII format.

1.2 Ethernet

The present developments in the field of Industrial Ethernet are based on the vision of an integrated access of all data of a company through a uniform communication system. In higher levels of enterprise communication Ethernet is the main medium of data transfers. Combined with other IT technologies it is internationally standardized. In the long run automation engineers will benefit from the rapid technological progress in the mass markets of IT and web technologies.

Ethernet technically provides a system with higher data transfer rates than common field bus systems. TCP/IP and UDP do have a statistical access method to access the medium thereby prohibiting determined response times. Many developments are intensely done on additional real time mechanisms, e.g. Ethernet Powerlink, Ethernet/IP, Profinet or EtherCat. However, you can already get access times that are sufficient for many applications when using TCP/IP or UDP. If you directly connect the absolute encoder to a computer via a 100 Mbit network card, you will get a cycle time of less than 2 ms. In huge networks the cycle times will depend on the utilization of the network.

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1.3 TCP/IP

Even though Ethernet and TCP/IP are often used together and sometimes used interchanged, these are three different kinds of terms and you should carefully separate them. The coherences are based on the ISO/OSI reference model after ISO/IEC 7498 that is needed to basically understand these terms.

Ethernet only describes layer 1 and 2 in this model, nevertheless the term is often used in error in engineering as description of all layers between 1 and 7.

The IP protocol of layer 3 was developed in the 70's by the US military (MIL-STD 1777). It allows a universal addressing independent of the hardware involved in heterogeneous networks. It also manages the transfer of large packets by splitting them up into smaller packets. The well-known TCP protocol (MIL-STD 1778) ensures a reliable data transfer.

Http (RFC 2068) and SMTP (MIL-STD 1781) belong to layer 7 of the OSI model and allow to transfer data and documents via web browser or to send e-mails.

1.4 UDP

User Datagram Protocol is utilized to send data that does not need to be transferred in a reliable way. The UDP packet is encapsulated in an IP packet which in turn is encapsulated in a PPP packet. Both UDP and IP have checksum octets and the PPP packet has its FCS octets however this can only guarantee that the data and the destination are correct. If a packet is lost, it will not be resent using UDP, this issue is only addressed by the TCP protocol.

1.5 OSI-Model

Layer			
7	Application Layer	SMTP, FTP, HTTP	Application
6	Presentation Layer		
5	Session Layer		
4	Taransport Layer	TCP and UDP	Data transport
3	Network Layer	IP and IPX	
2	Data Link Layer	Ethernet	
1	Physical Layer	10 BASE T, 100 BASE T	Cable

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2 Hardware setup and Ethernet Connection

2.1 Network Topology

Using Ethernet there are different kinds of topologies possible. The connection of the encoder can be made both directly to the computer with a network card or indirectly with a switch, hub or company network, see figure below. If you use a direct connection to a computer without network components in between, you need to use a standard, “straight” network cable (not a crossover cable). You need at least a cable of category 5 to get a data transfer rate up to 100 Mbit. If there is a network component in the network, which does not provide Fast Ethernet, the sensor will automatically switch down to 10 Mbit.

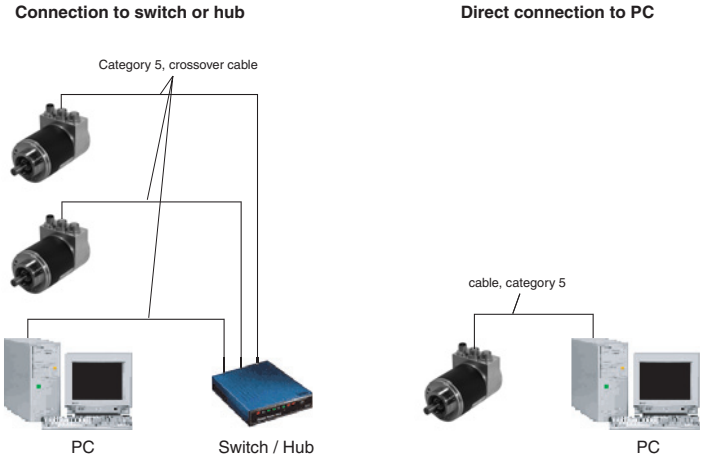

Figure 2.1: Network topology

Note

For connection with PC or notebook with other network components in between, a crossover cable must be used.

Note

To achieve a data transfer rate of 100 Mbit/s, a category 5 cable must be used. If one of the network components does not support Fast Ethernet, the encoders data transfer rate switches to 10 Mbit/s automatically.

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2.2 Connecting an Absolute Encoder

The encoder is connected by a 5 pin M12 connector for the power supply and one 4 pin, D coded M12 connector for Ethernet.

Ethernet connector

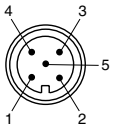
4-pin female connector, D-coded

Pin	Signal	Pinout
1	Rx+	
2	Tx+	
3	Rx-	
4	Tx-	

Our Ethernet encoders are equipped with a second D-coded M12 connector. This provides an integrated Hub functionality.

Supply connector

5-pin male connector, A-coded

Pin	Signal	Pinout
1	+24 V DC	
2	+ 24 V DC	
3	GND	
4	GND	
5	PE	

2.3 Ethernet Cables

2.3.1 RJ45 – M12 crossed

Signal	RJ45 Pin	M12 Pin	Signal
Tx+	1	2	Rx+
Tx-	2	4	Rx-
Rx+	3	1	Tx+
Rx-	6	3	Tx-

2.3.2 RJ45 – M12

Signal	RJ45 Pin	M12 Pin	Signal
Tx+	1	1	Tx+
Tx-	2	3	Tx-
Rx+	3	2	Rx+
Rx-	6	4	Rx-

2.3.3 M12 – M12 crossed

Signal	M12 Pin	M12 Pin	Signal
Tx+	1	2	Rx+
Tx-	3	4	Rx-
Rx+	2	1	Tx+
Rx-	4	3	Tx-

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2.4 Diagnosis LEDs

LED	Colour	Description for LED = on
Rx1	yellow	Incoming and outgoing traffic for port 1
Link1	green	Link to another Ethernet component for port 1
Collosion1 *	red	Ethernet collisions on the bus for port 1
Rx2 *	yellow	Incoming and outgoing traffic for port 2
Link2 *	green	Link to another Ethernet component for port 2
Collosion2 *	red	Ethernet collisions on the bus for port 2
Error *	red	-
Run *	green	-

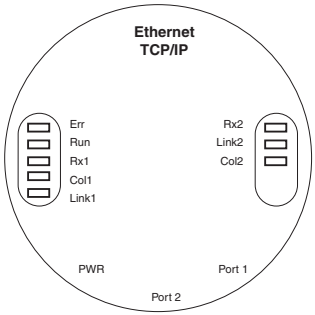

Figure 2.2: Diagnosis LEDs

3 Programming

3.1 Programming of Parameters

The encoder is able to provide three different kinds of output data:

- the position value
- a velocity value
- and a time stamp.

These can be used in arbitrary combinations.

Parameter	Description
Used scope of physical resolution (parameter 1.)	Specifies the part of the physical resolution used for the encoder in physical steps. If e.g. for an encoder with a resolution of 8192 steps per revolution 16384 is chosen, the encoder will count 8192 steps per revolution (if "Total scaled resolution" is set to the same value as "Used scope of physical resolution") and start with zero again after 2 revolutions. If this value is not set to a value which results in an integer division with the total physical resolution, the encoder value will jump to zero when passing the physical zero point. See figure 3.1
Total scaled resolution (parameter 2.)	Specifies the scaled resolution which is used over the area of physical steps defined by "Used scope of physical resolution". If e.g. the encoder is set as described above and "Total scaled resolution" is set to 10, the encoder will count 10 steps over the physical steps defined with "Used scope of physical resolution", i.e. 5 steps per revolution. See figure 3.1
Code sequence	The code sequence (complement) can be programmed as an operating parameter. This parameter determines whether the output code increases or decreases when the axis is turned clockwise.
Preset value	The preset value is the desired output value for the actual position of the axis. The actual output value will be set to this preset value.

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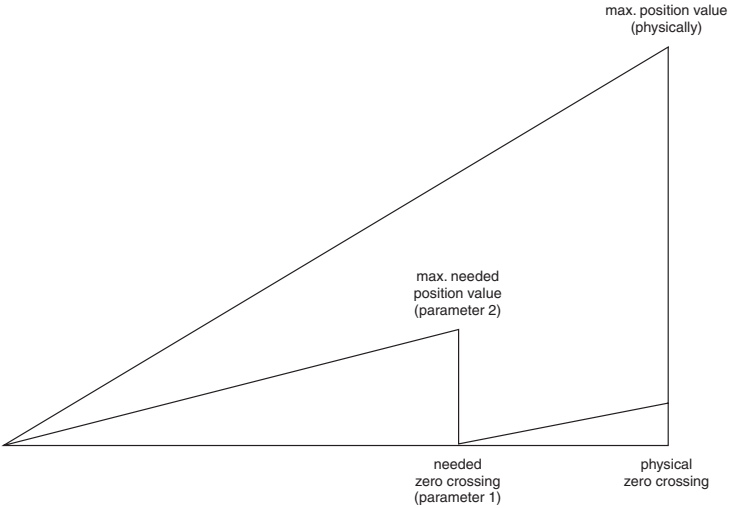

Figure 3.1: Parameterisation of position value and preset value

The html page, the programmable parameters, and the diagnostics of the encoder are described in the next chapter.

3.2 Operating by the integrated Web Server

The absolute rotary encoder can be addressed by any web browser (e.g. Netscape, Internet Explorer, Opera, etc.). Please enter the IP address of the encoder in the address field of the browser. The factory setting for the IP address is 10.10.10.10. chapter 3.2.2 will deal with changing the IP address.

3.2.1 Main Controller Site

If the encoder has built up a connection to the browser, you can see its start page. To be able to parameterize the encoder

please open the page “Main Controller Site“ (see image below). The other links on the starting page, will open a html page showing all available commands („Information about Commands“) or the page to configure the network settings. The chapter 4 describes these commands in more detail.

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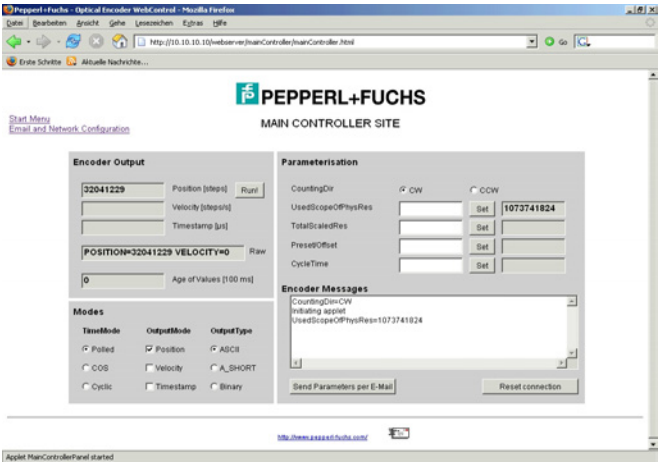
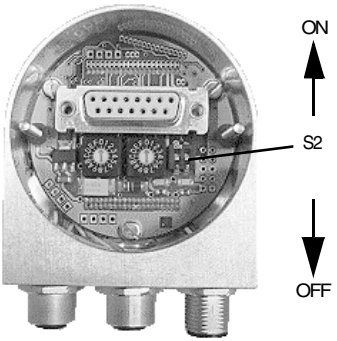


Figure 3.2: Main Controller Site

To read, for example, the position value continuously please set the desired cycle time and choose the cyclic mode. Each command to the encoder and messages from the encoder are logged in the encoder message window.

3.2.2 E-mail and network configuration



The rotary encoder can be used either with the wired IP 10.10.10.10 or the software IP address which can be programmed. A switch to choose either option is located in the connection cap. If the switch 2 is in position “off”, the programmable IP has been chosen. Both Hex rotary switches and switch 1 are not in use for this encoder. The configuration window can be accessed via the “Main Controller Site” or the start page.

Figure 3.3: switch S2

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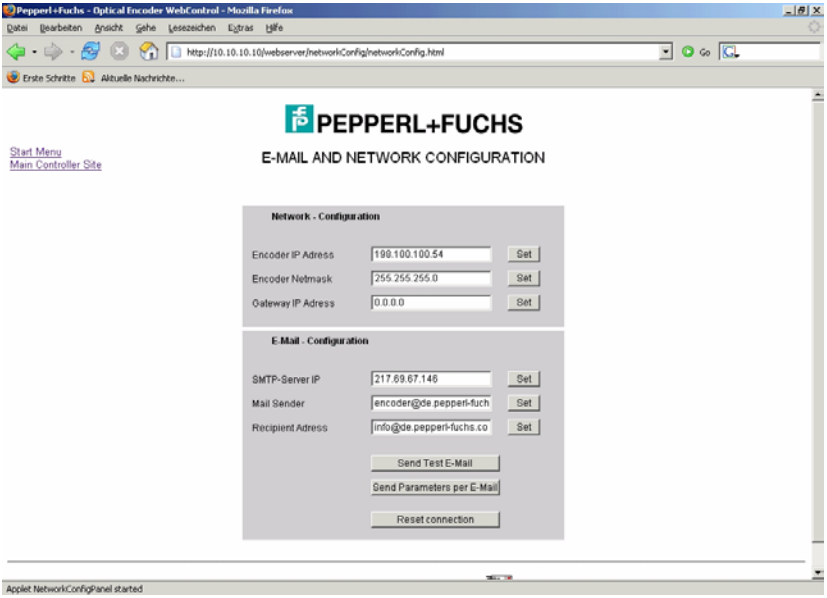

Figure 3.4: E-mail and Network Configuration screen

4 Operating by TCP/IP Commands

4.1 Introduction

To use the absolute encoder with a control system platform independent commands and data in ASCII format can be exchanged by TCP/IP. To take a look at the commands and a short description please see chapter 4.6. To find out how to address the TCP/IP interface of your control or operating system please refer to the documentation for these devices.

If you use a Windows PC, you can try the following connection to the sensor:

- Go to the command prompt (DOS) and type in “ping <computer-name>” or “ipconfig”. In response you get the IP address of your computer.
- If the encoder IP address is not located within your subnet mask, you will need to prepare the data transfer to the encoder by entering the command “route add <IP-sensor> <IP-computer>“. Maybe administrator rights are necessary. Otherwise your PC/control system will try to reach the encoder via your computers standard gateway. The default IP address of the sensor is 10.10.10.10.
- You can check the connection to the sensor with the command “ping <IP-sensor>“.

4.2 Installation

To communicate with the Encoder using our example tools tcpcl or updcl, a Java runtime environment is required on your PC. If you have not installed Java, you can get it from our CD (look under the section “accessories”). You can also download the latest version from http://java.sun.com/products/j2se. Copy the Pepperl+Fuchs Java programs which you can find on our CD in the folder ”CD_Manual+Tools\EthernetEncoderTools“ or on our web site http://www.pepperl-fuchs.com onto your hard disk, e.g. in the folder c:\pf\ethernet.

Afterwards you need to set up the PATH variable for the Java installation and the Pepperl+Fuchs Java programs. For a convenient start we also provided batch files to start

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the java files, depending on the IP addresses you might need to modify them. For TCP will be used port 6000.

4.3 Path Variable

4.3.1 MS-DOS, Win95, Win98, WinME

Please add the required paths to c:\Autoexec.bat behind the “Path” line. Example:

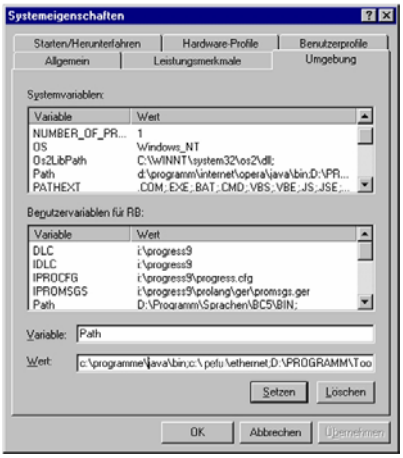
Path=c:\ms-dos; c:\Program Files\BC\BIN

Path=%Path%;c:\pf\ethernet\

Path=%Path%;c:\programme\java\bin

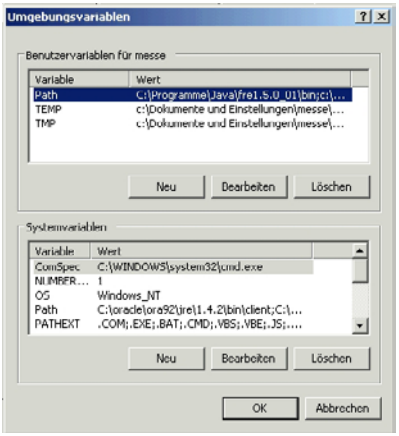
4.3.2 WinNT3.51, WinNT4, Win2000

In Start – Settings – Control panel – System – Advanced – Environment Variables you can configure the variable “Path”. Please do not change the other path settings, but only add the required paths! Depending on the operating system used administrator rights might be necessary.



4.3.3 WinXP

In Start – Settings – Control panel – System – Advanced – Environment Variables you can configure the variable “Path”. Please do not change the other path settings, but only add the required paths! Depending on the operating system used administrator rights might be necessary.



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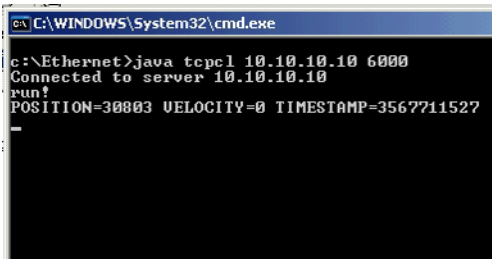
4.4 Operating

After starting the batch file TCP_10101010.bat the connection to the encoder will be built up. Once you are connected, you can try e.g. “read offset” (please note the space) to read out the calculated offset from the encoder. You can see all available commands in the next chapter.



If the encoder is running in cyclic mode, you can see position values coming continuously from the encoder. You can enter a command anyway, although your input will be overwritten by new position values, the command will still be sent once you press enter.

The Java program can be finished with CTRL-C.

4.5 Advanced functionality

In the subdirectory "advanced" on our CD there is a version of the TCP-client with enhanced functionality:

- the time from the command till the encoder issues an answer can be measured in steps of 10 ms. This can be switched on/off using time / notime.
- the binary values transmitted by the encoder can be transferred to ASCII again, if it does not contain ‘\0’ or ‘\n’. This can be switched by binary / ASCII, it will be automatically switched when the encoder is switched from/to binary mode.
- Scrolling of the output can be turned on/off via scroll / noscroll
- 'new' renews the connection to the encoder
- 'exit' will close the TCPClient application

4.6 Parameters

4.6.1 Network configuration commands

Note

Please note spaces, upper and lower case! <Value> means the parameter to enter. All commands and parameters have to be entered in one line and started with <ENTER>. “Value“ means the output value.

You can change and read the settings of the encoder by using the following commands:

Command	Description
Run!	This command will order the encoder to send a position value, regardless of the time mode.
set <Variable>=<Wert>	This command will set a variable to a given value. If successful, the encoder will answer in the form <Variable>=<Value>, else an error message will be issued. All variables/modes are stored in the internal flash a few seconds after they were set. After the value was saved, the message "Parameters successfully written!" is issued to all connected TCP-Clients. If the encoder is turned off while writing to the flash, the process can damage the flash and destroy the encoder program. ***Please take care under all circumstances that the encoder is not turned off while it is writing to the flash !***
read <Variable>	This command will read out a variable from the encoder. The encoder will answer in the form <Variable>=<Value>.

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4.6.2 Encoder Variables

Variable	Remarks / Values
UsedScopeOfPhysRes	Specifies the part of the physical resolution used for the encoder in physical steps. If e.g. for an encoder with a resolution of 8192 steps per revolution 16384 is chosen, the encoder will count 8192 steps per revolution (if TotalScaledRes is set to the same value as UsedScopeOfPhysRes) and start with zero again after 2 revolutions. If this value is not set to a value which results in an integer division with the total physical resolution, the encoder value will jump to zero when passing the physical zero point. Default value: Physical resolution of the type label. I.e. 4096 resolutions x 8192 steps per revolution = 33,554,432
TotalScaledRes	Specifies the scaled resolution which is used over the area of physical steps defined by UsedScopeOfPhysRes. If e.g. the encoder is set as described above and TotalScaledRes is set to 10, the encoder will count 10 steps over the physical steps defined with UsedScopeOfPhysRes, i.e. 5 steps per revolution. Default value: Physical resolution of the type label. I.e. 4096 resolutions x 8192 steps per revolution = 33,554,432
CountingDir	Specifies the direction to turn the axis which is associated with higher values. • CW: denotes that clockwise turning will increase the position value • CCW: denotes that counterclockwise turning will increase the position value
Preset	When the preset is set, an internal offset will be calculated, which will be saved and added to all position values afterwards. The value given for the preset denotes the position value the encoder will show at the point where the preset was set.
Offset	This variable makes it possible to directly change the offset calculated and set by the preset function.
TimeMode	Possible time modes are: • polled: Encoder will only send output values if asked to do by "Run!". • cyclic: Encoder will send output values after time specified by CycleTime. • change of state: The Encoder will send the output values only if either the position or the velocity has changed. The values are checked every 5 ms to reduce unwanted network traffic.
OutputMode	Possible output modes are: [Position_][Velocity_][Timestamp_] where the components mean: • Position: Encoder will send a scaled Position value. • Velocity: Encoder will send a velocity Value (steps/s). • Timestamp: Encoder will send a timestamp in microseconds, starting with 0 at the startup of the encoder. As the counter is a 32 Bit value, the timestamp will reach zero again after approx. 1.2 hours.
OutputType	Possible output types are: • ASCII: Encoder will send ASCII-letters in the form "POSITION=<POSITION> VELOCITY=<VELOCITY> TIMESTAMP=<TIME>" • ASCII_SHORT: Encoder will send ASCII-numbers in the form "<POSITION> <VELOCITY> <TIME>", separated by spaces • BINARY: Encoder will send 32 bit binary values without any separator between the values.
CycleTime	States the time in ms for the cyclic time mode. Can have values between 1 ms and 999,999 ms.
IP	Sets the IP-address of the encoder and must be a valid IP-address in the form a.b.c.d, with a, b, c, d from 0 to 255. **Attention:** The IP-address will only be activated after a new power-up when switch 2 is in position “off”.
NetMask	The net mask used by the encoder. Please take care that Encoder and PLC/PC are within the same subnet or specify a working gateway..
Gateway	Gateway to be used by the encoder, if own IP-address and destination IP address are not within the same subnet specified by the net mask.

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Variable	Remarks / Values
OwnEmailAddr	The email-address given as the sender in emails from the encoder.
RmtEmailAddr	The target e-mail address, where e-mails will be send to.
SMTPServerIP	The IP-address of the SMTP-server which the encoder will send the email by.
Verbose	Level of information output for tracer (0 = only errors, 1 = errors and warnings, 2 = errors, warnings and clues)

4.6.3 Encoder answers

Encoder answer	Remarks
<Variable>=<Value>	If a variable was correctly set, the encoder will answer to all connected TCP-clients with the variable and its new value. This indicates that the Encoder understood the command and now uses the value, it does not indicate that the value was already save to the internal Flash, please allow some additional seconds for that.
ERROR: ...	If something went wrong, the encoder will issue an error, e.g. if it did not understand a command or if a value for a variable was not correct. It will describe the error after the "ERROR:" tag.
WARNING: ...	If a variable was set to a value, which is permitted, but which may result in problems when certain conditions occur, the encoder will issue a warning. This could for example happen, if the variable UsedScopeOfPhysRes is set to a value which does not result in an integer division with the physical resolution of the encoder when dividing the total physical resolution of the encoder. The reason for the warning will be sent following the "WARNING:" tag.
Parameters successfully written!	If any variable was set, it is important to wait until the encoder displays this message before the encoder can be turned off, otherwise the internal flash might be damaged.

5 UDP transmission

After starting the batch file “UDP_10101010.bat”, which will start a UDP client on the PC and connect to the encoder, “run!” can be entered to read out the position value. As UDP is not connection oriented as TCP is, only the POLLED mode is supported using UDP; encoder values cyclically send will not be received by UDP clients.

The parameterisation of the encoder can only be changed by TCP-commands (see chapter 4). As UDP is not connection orientated. The encoder allows UDP-connections to port 5000 only.

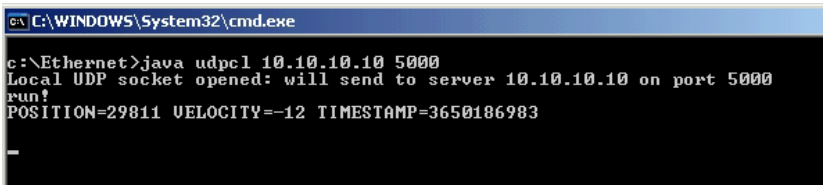

Figure 5.1: Input screen UDP

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6 Technical Data

Electrical specifications	
Operating voltage	10 ... 30 V DC
Power consumption P_0	max. 4 W
Linearity	± 0.5 LSB (12 Bit) ,
Output code	binary code
Code course (counting direction)	parameterisable, cw ascending (clockwise rotation, code course ascending) cw descending (clockwise rotation, code course descending)
Interface	
Resolution	
Singleturn	up to 16 Bit
Overall resolution	up to 16 Bit
Physical	Ethernet
Interface type	TCP/IP
Transfer rate	10 MBit/s / 100 MBit/s
Connection	
Connector	Ethernet: 2 sockets M12 x 1, 4-pin, D-coded Supply: 1 plug M12 x 1, 5-pin, A-coded
Standard conformity	
Protection degree	DIN EN 60529, shaft side: IP64 (without shaft seal)/IP66 (with shaft seal) housing side: IP65
Climatic testing	DIN EN 60068-2-3, no moisture condensation
Emitted interference	DIN EN 61000-6-4
Interference rejection	DIN EN 61000-6-2
Shock resistance	DIN EN 60068-2-27, 100 g, 6 ms
Vibration resistance	DIN EN 60068-2-6, 10 g, 10 ... 2000 Hz
Ambient conditions	
Operating temperature	0 ... 60 °C (273 ... 333 K)
Storage temperature	-40 ... 85 °C (233 ... 358 K)
Mechanical specifications	
Material	
Combination 1	housing: aluminium, powder coated flange: aluminium 3.1645 shaft: stainless steel 1.4305
Combination 2 (Inox)	housing: stainless steel 1.4305 flange: stainless steel 1.4305 shaft: stainless steel 1.4305
Mass	approx. 550 g (combination 1) approx. 1100 g (combination 2)
Rotational speed	max. 12000 min^{-1}
Moment of inertia	30 gcm^2
Starting torque	≤ 3 Ncm (version without shaft seal)
Shaft load	
Axial	40 N
Radial	110 N

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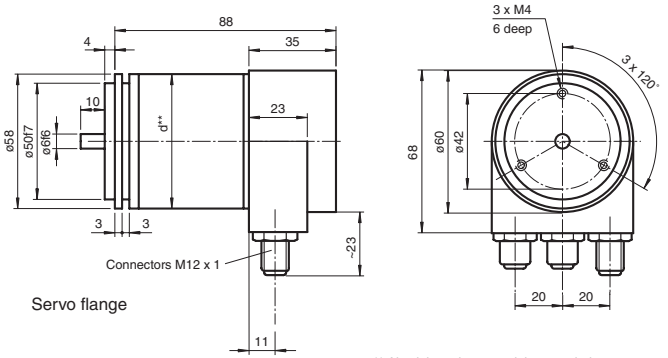
7 Dimension

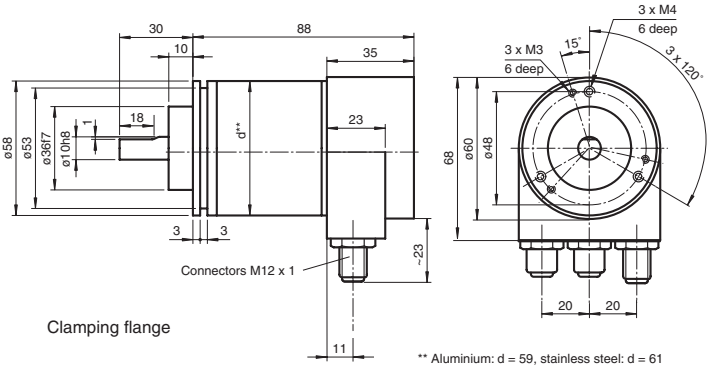
7.1 Servo flange



Servo flange

** Aluminium: d = 59, stainless steel: d = 61

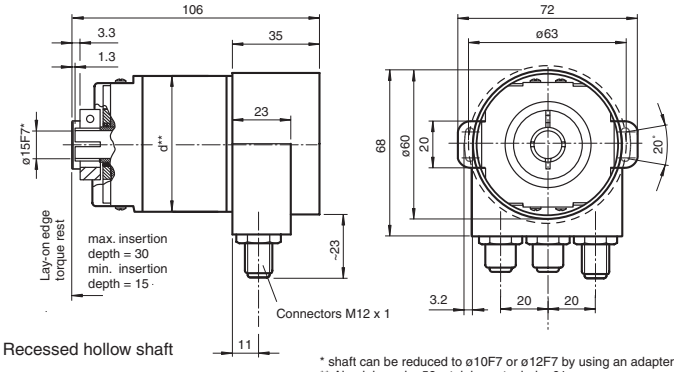
7.2 Clamping flange



Clamping flange

** Aluminium: d = 59, stainless steel: d = 61

7.3 Recessed hollow shaft



Recessed hollow shaft

* shaft can be reduced to ø10F7 or ø12F7 by using an adapter
** Aluminium: d = 59, stainless steel: d = 61

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8 Installation hints

8.1 Encoder installation

8.1.1 Rotary encoders with solid shaft

- Mounting solid shaft encoder with L-bracket
- Mounting solid shaft encoder with eccentric clamping element
- Mounting solid shaft encoder with mounting bracket

See catalogue "Rotary Encoders", chapter "Accessories".

8.1.2 Rotary encoders with recessed hollow shaft

- Directly on the propulsion shaft

The clamp ring must only be tightened after the shaft of the driving element was inserted into the hollow shaft.

The diameter of the hollow shaft can be reduced to 12 mm, 10 mm or 8 mm by using an adapter (this reducing adapter can be pushed into the hollow shaft).
See catalogue "Rotary Encoders", chapter "Accessories".

8.2 Use of couplings with solid shaft encoders

In order to prevent impermissibly high loads on the bearing, it is imperative to link the solid shaft encoder and the drive shaft with a flexible coupling.

Misalignment faults, such as radial, axial or angular misalignment, occur despite highly precise production and mounting action of the drive shaft. Frequently they are caused by temperature influences. A rigidly mounted encoder with its bearings free from clearance and the bearing of the drive shaft constitute a rigid system. The forces occurring in this system destroy the encoder by excessive axial and radial forces.

The higher the torsional rigidity of the coupling, the lower is the torsional error between encoder and drive.

The restoring forces of the coupling are in direct correlation with the compensatory movement of the coupling. These forces must not exceed the permissible axial and radial forces.

For data on the permissible radial, axial or angular misalignment, please refer to the data sheets.

Maximum radial and axial misalignment of the drive shaft:

	axial	radial
statical	± 0.3 mm	± 0.5 mm
dynamical	± 0.1 mm	± 0.2 mm

Table 8.1: maximum shaft misalignment

Suitable couplings for all application, you can find in our catalogue "Rotary Encoders", chapter "Accessories".

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9 Installation instructions

9.1 Anti-interference measures

The use of highly sophisticated microelectronics requires a consistently implemented anti-interference and wiring concept. This becomes all the more important the more compact the constructions are and the higher the demands are on the performance of modern machines.

The following installation instructions and proposals apply for "normal industrial environments". There is no ideal solution for all interfering environments.

When the following measures are applied, the encoder should be in perfect working order:

- The wiring of the encoder should be laid at a large distance to energy lines which could cause interferences.
- Cable cross-section of the screen at least 4 mm².
- Cable cross-section at least 0.14 mm².
- The wiring of the screen and 0 V should be arranged radially, if and when possible.
- Do not kink or jam the cables.
- Adhere to the minimum bending radius as given in the data sheet and avoid tensile as well as shearing load.

9.2 Operating instructions

Every encoder manufactured by Pepperl+Fuchs leaves the factory in a perfect condition. In order to ensure this quality as well as a faultless operation, the following specifications have to be taken into consideration:

- Avoid any impact on the housing and in particular on the encoder shaft as well as the axial and radial overload of the encoder shaft.
- The accuracy and service life of the encoder is guaranteed only, if a suitable coupling is used.
- The operating voltage for the encoder and the follow-up device (e. g. control) has to be switched on and off simultaneously.
- Any wiring work has to be carried out with the system in a dead condition.
- The maximum operating voltages must not be exceeded. The devices have to be operated at extra-low safety voltage.

9.3 Notes on connecting the electric screening

The immunity to interference of a plant depends on the correct screening. In this field installation faults occur frequently. Often the screen is applied to one side only, and is then soldered to the earthing terminal with a wire, which is a valid procedure in LF engineering. However, in case of EMC the rules of HF engineering apply.

One basic goal in HF engineering is to pass the HF energy to earth at an impedance as low as possible as otherwise energy would discharge into the cable. A low impedance is achieved by a large-surface connection to metal surfaces.

The following instructions have to be observed:

- Apply the screen on both sides to a "common earth" in a large surface, if there is no risk of equipotential currents.
- The screen has to be passed behind the insulation and has to be clamped on a large surface below the tension relief.
- In case of cable connections to screw-type terminals, the tension relief has to be connected to an earthed surface.
- If plugs are used, metallised plugs only should be fitted (such as Sub-D plugs with metallised housing). Please observe the direct connection of the tension relief to the housing.

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10 Glossary

10 Base T	Transmission line with 10 Mbit data transmission rate
100 Base T	Transmission line with 100 Mbit data transmission rate
ASCII	American Standard Code for Information Interchange ASCII describes as code the correlation from digital integers to a normal font described character.
Batch-file	Script program for MS-DOS
Baudrate	Transmission rate; it display the transmission bits per second
Binary	Numeric system with value 0 or 1.
Browser	Software program to display HTML-Sides on different operating systems (Linux, Unix, Windows, ...)
CAT5	Terminations for transmission rates up to 100 Mbit.
CRC	The cyclic redundancy check is a method from the information technology to control a checksum for data, to reduce errors by the transmission.
EMC	Electromagnetic compatibility, there are rules to verifying devices.
Ethernet	Ethernet is a computer network technology based on frames.
Fast Ethernet	Transmission technology with 100 Mbit transmission rate.
FCS-Bytes	The Frame Check Sequence-Bytes are a 32 Bit CRC-Checksum.
Flash	Internal memory, saved data will be available after power down.
HTML	The Hypertext Markup Language is a document format used in the World Wide Web to be displayed by a browser
HTTP	The Hypertext Transfer Protocol is a stateless transmission protocol for data transmission.
Hub	The hub connects different network segments e.g. in an Ethernet network.
IP-address	IP-address allow a logic addressing from computer in a network.
IP-protocol	The Internet Protocol is widespread in computer networks. It is the implementation of the internet layer of the TCP/IP-model
Mbit	Transmission rate or baud rate, million bits per second
OSI-Modell	The Open System Interconnection reference model is a open layer model for the organisation of a communication.
PPP-Packet	The Point-to-Point Protocol will be need for a connection establishment. It enables the transmission between different network protocols.
SMTP	Simple Mail Transfer Protocol managed the transmission of e-mails.
Switch	A switch is an electronic device to connect computers e.g. network segments in a local network. Unlike a hub, a switch uses stacks to avoid network collisions.
TCP	The Transmission Control Protocol is a connection orientated transmission protocol, in a network.
TCP-Client	MS-DOS program available from Pepperl+Fuchs to communicate with the encoder.
UDP	User Datagram Protocol is utilized to send data that does not need to be transferred in a reliable way.

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With regard to the supply of products, the current issue of the following document is applicable: The General Terms of Delivery for Products and Services of the Electrical Industry,
published by the Central Association of the Electrical Industry (Zentralverband Elektrotechnik und Elektroindustrie (ZVEI) e.V.)
in its most recent version as well as the supplementary clause: "Expanded reservation of proprietorship"

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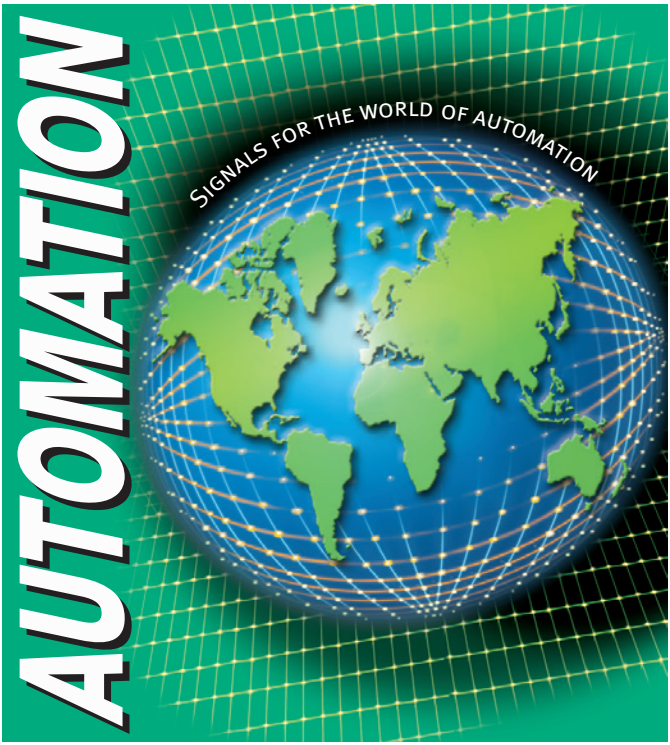
For this reason, this printed matter is produced on paper bleached without the use of chlorine.



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