USER MANUAL



EtherNet/IP[®]

USER MANUAL

Imprint

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IXARC Absolute ROTARY ENCODER WITH

ETHERNET/IP Interface Error! Bookmark not defined.

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1. Introduction

Absolute rotary encoders provide a definite value for every possible position. All these values are reflected on either code discs, or Hall-effect sensors, depending on the used technology. In the case of an optical encoder, the beams of infrared LEDs are sent through code discs and detected by Opto-Arrays. For a magnetic one, a rotating magnet attached to the shaft creates a field whose direction is measured by the Hall-effect sensor. 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 bits). The multiturn version can detect up to 16,384 revolutions (14 bits). Therefore, the largest resulting resolution is 30 bits = 1,073,741,824 steps. The standard singleturn version is 13 bits, the standard multiturn version 25 bits.

The integrated Ethernet interface of the absolute rotary encoder supports all necessary EtherNet/IP functions.

The protocol supports the programming of the following additional functions in several ways:

- 1. Code sequence (complement)
- 2. Resolution per revolution
- 3. Total resolution
- 4. Preset value
- 5. IP-Address
- 6. DLR

The functioning of the absolute rotary encoders under general aspects of the EtherNet/IP interface is guaranteed. The data will be transmitted in a standard Ethernet frame in the data section (see at the bottom of this side the pink field with the blue frame).

The MAC address of each encoder is available on the type of label.

The IP address can be programmed with BOOTP via the configuration tools of the PLC.

The physical interface supports auto negotiation and auto crossing.

General information's about EtherNet/IP are available at:

www.ethernetip.de (German) https://www.odva.org/technology-standards/key-

technologies/ethernet-ip/ (English)



Setup of an Ethernet data package on layer 2



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1.1 Control and Information Protocol (CIP)



Figure 2: CIP OSI Layers

The EtherNet/IP specification defines the Application Layer and the Physical Layer. The Data Link layer is based on the CAN-specification. For the optimal industrial control will be defined two different messaging types. I/O messaging (Implicit Messaging) and explicit messaging. With Implicit Messaging, I/O data are exchanged in real time whereas Explicit Messaging is mostly used for device configuration. CIP (Common Industrial Protocol) make for the user available four essential functions:

- Unique control service
- Unique communication service
- Unique allocation of messaging
- Common knowledge base

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1.2 Object model

EtherNet/IP describes all data and functions of a device considering an object model. By means of that object-oriented description, a device can be completely defined with single objects. An object is defined across the centralization by associated attributes (e.g. process data), its functions (read

or write access of a single attribute) as well as by its defined behaviors. The absolute rotary encoder supports the Encoder Device Type: 22_{hex}. This is programmable, see chapter 4.1. All parameters will be used with Big Endian notation.



Figure 3: Ethernet/IP Object Model

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2. Data Transmission

The data transmission within the EtherNet/IP network is realized by implicit or explicit messaging. Explicit messages are split in unconnected and

connection-based versions. Unconnected messages will be used by EtherNet/IP scanners.



Figure 4: Data Transmission in Ethernet/IP

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Input Only

It is possible to open 5 implicit and 15 explicit connections with the encoder. Input Only connections can only work if all of the parameters are set in the PLC accordingly to the encoder parameters.

Assembly	Config	Output Instance	Input Instance
Connection Manager	Config	Connection Point 1	Connection Point 2
Input Only	0x7A _{hex} (122)	0x69 _{hex} (105)	0x01 Position value 0x03 Position value + velocity

Table 1: Communication Messages

Figure 5: Generic Module Communication Parameters

Type: Vendor: Parent	ETHERNET-MODULE Generic Ethern Allen-Bradley LocalENB	et Module			
Name:	OCD	Connection Para	ameters		2
Description			Assembly Instance:	Size:	
	2	Input	3	2	÷ (32-bit)
	<u> </u>	Output:	105	0	-
Comm Forma - Address / H	t: Input Data - DINT 🔹	Configuration:	106	12	÷ (8-bit)
IP Addr	ess: 192 . 168 . 0 . 252	Status Input			
C Host N	ame:	Status Output:			

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2.1 Implicit Messaging I/O Connection

Provide dedicated, special-purpose communication paths between a producing application and one or more consuming applications for the purpose of moving application-specific data. This is often referred to as implicit messaging. Class 0 and 1 are supported.

Instance	Туре	Name
1	Input	Position Value 32 bits unscaled
2	Input	Position Value 32 bits scaled and Warning Flag 8 bits
3	Input	Position Value 32 bits and Velocity 32 bits
120	Input	Position Value 32 bits, Velocity Value 32 bits, Acceleration Value 32 bits and Warning Flag 8 bits
121	Input	Position Value 32 bits, Velocity Value 32 bits, Acceleration Value 32 bits,
		Temperature Value 32 bits and Warning Flag 8 bits
122	Output	per Revolution 32 bits, Total Measuring Range 32 bits, Velocity Format 16 bits, Velocity Filter 8 bits, Parameter Control Priority 8 bits

2.1.1 I/O Assembly Instances

Table 2: I/O Assembly Instances

2.1.1.1 Data Attribute Format

2.1.1.1 Data A	ttribute Fo	rmat		1	1	т	1		1	
Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
	0	Position Value (low Byte)								
1	1									
	2									
	3	Position Value (high Byte)								
	0	Position	Value (low	/ Byte)						
	1									
2	2									
	3	Position	Value (hig	h Byte)						
	4							Warning	Alarm	
	0	Position	Value (low	/ Byte)						
	1									
	2									
2	3	Position	Value (hig	h Byte)						
3	4	Velocity	Value (Iow	v Byte)						
	5									
	6									
	7	Velocity	Value (hig	h Byte)						

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Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0		
	0	Position Value (low Byte)									
	1										
	2										
120	3	Position Value (high Byte)									
	4	Velocity Value (low Byte)									
	5										
	6										
	7	Velocity	Value (hig	h Byte)							
	8	Accelera	ation Value	e (Iow Byte	e)						
	9										
	10										
	11	Accelera	ation Value	e (high Byt	e)						
	12							Warning	Alarm		
	0	Position	Value (lov	v Byte)							
	1										
	2										
	3	Position	Value (hig	h Byte)							
	4	Velocity	Value (low	/ Byte)							
	5										
	6										
	7	Velocity	Value (hig	h Byte)							
121	8	Accelera	ation Value	e (Iow Byte	e)						
	9										
	10										
	11	Accelera	ation Value	e (high Byt	e)						
	12	Tempera	ature Value	e (low Byte	e)						
	13										
	14										
	15	Tempera	ature Value	e (high By	te)			-			
	16							Warning	Alarm		

Table 3: Data Attribute Format

2.1.2 Data Mapping

2.1.2 Data Mapping									
Data Component	Class		Instance	Attribute					
Name	Name Number		Number	Name	Number				
Position Value Unscaled	Position Sensor	23 _{hex}	1	Position Value unscaled	03 _{hex}				
Velocity	Position Sensor	23 _{hex}	1	Velocity	18 _{hex}				
Acceleration	Position Sensor	23 _{hex}	1	Acceleration	1D _{hex}				
Warning flag	Position Sensor	23 _{hex}	1	Warning flag	7Chex				
Temperature Value	Position Sensor	23 _{hex}	1	Temperature Value flag	7D _{hex}				

Table 4: Data Mapping

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2.1.3 Data Mapping (Parameter)

On every Forward Open Request, the following encoder. parameters will be sent from the controller to the

Configuration Parameter	onfiguration Parameter Class		Instance	Attribute	
Name	Name	Number	Number	Name	Number
Direct Counting Toggle	Position Sensor	23 _{hex}	1	Direct Counting Toggle	0Chex
Scaling Function Control	Position Sensor	23 _{hex}	1	Scaling Function Control	0Ehex
Measuring units per	Desition Sensor	23 _{hex}	1	Measuring Units per Span	10
Revolution	Position Sensor				TUhex
Total Measuring Range	Desition Sensor	23 _{hex}	1	Total Measuring Range in	11.
in measuring units	Position Sensor	1501		measuring units	I I hex
Velocity Format	Position Sensor	23 _{hex}	1	Velocity Format	19 _{hex}
Velocity Filter	Position Sensor	23 _{hex}	1	Velocity Filter	70 _{hex}
Parameter Control	Desition Concer	23 _{hex}	1	Devery star Control Drights	74
Priority	Position Sensor			Parameter Control Priority	/ Thex
	O		_		

Table 5: Assembly Instance Configuration: 7, size 14 Bytes

2.1.3.1 Data Offset

Instance	Byte Offset	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	0	Direction	Counting	Toggle					
	1	Scaling Function Control							
	2	Measurir	ng Units pe	er Revolut	ion (low By	∕te)			
	3								
	4								
	5	Measuring Units per Revolution (high Byte)							
122 6 Total Measuring Range in Measuring Units (low Byte) 7					Byte)				
					-				
	8								
	9	Total Measuring Range in Measuring Units (high Byte)							
	10	Velocity Format (low Byte)							
	11	Velocity Format (high Byte)							
	12	Velocity Filter							
	13	Paramet	er Control	Priority					

Table 6: Data Offset

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2.1.4 Connection Path

Is made of a byte stream that defines the application object to which a connection instance applies. This path will be created in the configuration tools and is available in the EDS file too.

This path will be sent to the encoder during power up. For some tools it is necessary to use the connection path as a parameter:

[20] [04] [24 7A] <mark>[24 69] [24 01]</mark> [80 07 00 01 00100000 00200000 1F04 01 00]

Segment Groups	Segment	Description
Application Path	<mark>20 04</mark>	Assembly object class
	<mark>24 7A</mark>	Instance segment type with Assembly Instance
		0x7A _{hex} (122) (Configuration)
	<mark>24 69</mark>	Assembly Instance 0x69hex (105) (Output
		controller to encoder)
	<mark>24 01</mark>	I/O Assembly Instance 1 (Position value)
	<mark>80 07</mark>	Data segment with lenght of 6 Bytes
	00 01 00100000 00200000 1F04 01 00	Configuration Data, see chapter 2.1.3.1 for
		details

Table 7: Connection Path

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2.2 Explicit Messaging

Provide generic, multi-purpose communication paths between two devices. These connections often are referred to as just Messaging Connections. Explicit Messages provide the typical request/response-oriented network communications. Class 2 and 3 are supported.

2.2.1 CIP Common Services for Position Sensor Objects (Class 0x23hex)

Save / Restore

Supported Service Code	Service Name	Comment
05 _{hex}	Reset	Boot up of the encoder, the programmed parameter
		from the customer will use again
0E _{hex}	Get_Attribute_Single	Read out attribute from the encoder
10 _{hex}	Set_Attribute_Single	Write attribute to the encoder
15 _{hex}	Restore	Restore the saved parameters. Use instance 0 of
		position sensor class to restore all configuration
		parameters at once. To restore a single parameter,
		use instance 1 of position sensor class with attribute
		number as argument (see next table).
16 _{hex}	Save	Save the parameters from chapter 2.1.3 in the
		nonvolatile memory. Use instance 0 of position
		sensor class to save all configuration parameters at
		once.

Table 8: CIP Position Sensor Objects – Save / Restore

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2.2.2 Position Sensor Objects

Instance Attributes (Get: read, Set: write + read) // Class Code: 23hex

Attrib. ID	Access	Name	Data Type	Description
0A _{hex}	Get	Position Value Unsigned	DINT	Unscaled position (32 bits)
0C _{hex}	Set	Direction Counting Toggle	Boolean	Controls the code sequence clockwise or counterclockwise
0E _{hex}	Set	Scaling Function Control	Boolean	Scaling function on/off
10 _{hex}	Set	Measuring units per Span	UDINT	Resolution for one revolution
11 _{hex}	Set	Total Measuring Range in Measuring Units	UDINT	Total resolution
18 _{hex}	Get	Velocity Value	DINT	Current speed in format of attribute 19 _{hex} and 2A _{hex}
19 _{hex}	Set	Velocity Format	ENGUINT	Format of the velocity attributes
1D _{hex}	Get	Acceleration Value	DINT	Current acceleration in rad/s ²
70 _{hex}	Set	Velocity Filter	DINT	Fine = 0, Normal = 1, Coarse = 2
71 _{hex}	Set	Parameter Control Priority	USINT	Choice between PLC or NVM configuration
7Chex	Get	Warning Flags	WORD	Internal parameters exceeded
7D _{hex}	Get	Temperature Value	DINT	Value of the encoder's temperature un °C

Table 9: CIP Position Sensor Objects – Instance Attributes

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2.3 TCP/IP Interface Object

The TCP/IP Interface Object provides the mechanism to configure a device's TCP/IP network interface. With these parameters it is

possible for example to read or write the device's IP Address and Network Mask.

Class	Code:	F	5 _{hex}

class Code:	F5hex			
Attribute ID	Access	Name	Data Type	Description
01 _{hex}	Get	Status	DWORD	Interface status, details in chapter 2.3.1
02 _{hex}	Get	Configuration Capability	DWORD	Interface capability flags, details in chapter 2.3.2
03 _{hex}	Set	Configuration Control	DWORD	Interface control flags, details in chapter 2.3.3
04 _{hex}	Get	Physical Link Object	STRUCT of:	Path to physical link object
		Path size	UINT	Size of path
		Path	Padded EPATH	Logical segments identifying the physical link object
05 _{hex}	Set	Interface Configuration	STRUCT of:	TCP/IP network interface configuration
		IP Address	UDINT	The device's IP address
		Network Mask	UDINT	The device's network mask
		Gateway	UDINT	Default gateway address
06 _{hex}	Set	Host Name	STRING	
10 _{hex}	Set	Select ACD (ACSI)	BOOLEAN	Not Supported
		Last Conflict Detected (ACSI)	STRUCT of:	
		Add Activity	USINT	
11 _{hex}	Set	Remote MAC	Array of 6 USINT	Not Supported
		ArpPdu	Array of 28 USINT	
13 _{hex}	Set	Encapsulation Inactivity Timeout	UINT	Number of seconds of inactivity before connection is closed

Table 10: TCP/IP Interface Objects Overview

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2.3.1 Status Instance Attribute (01hex)

Bit(s)	Called	Definition		
0-3	Interface Configuration Status	Indicates the status of the Interface Configuration attribute.	 0 = The Interface Configuration attribute has not been configured. 1 = The Interface Configuration attribute contains valid configuration obtained from BOOTP or nonvolatile storage. 2 = The Interface Configuration attribute contains valid configuration, obtained from hardware settings (e.g.: push wheel, thumbwheel, etc.) 3-15 = Reserved for future use. 	
4	Mcast Pending	Indicates a pending configuration change in the TTL Value and/or Mcast Config attributes. This bit shall be set when either the TTL Value or Mcast Config attribute is set and shall be cleared the next time the device starts.		
5	Interface Configuration Pending	Indicates a pending configuration change in the Interface Configuration attribute. This bit shall be 1 (TRUE) when Interface Configuration attribute are set and the device requires a reset in order for the configuration change to take effect (as indicated in the Configuration Capability attribute). The intent of the Interface Config Pending bit is to allow client software to detect that a device's IP configuration has changed, but will not take effect until the device is reset.		
6-31	Reserved	Reserved for future use and shall be set to zero.		

Table 11: TCP/IP Interface Objects – Attribute 01hex

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2.3.2 Configuration Instance Attribute (02hex)

Bit(s)	Called	Definition
0	BOOTP Client	1 (TRUE) indicates that the device is capable of obtaining its network configuration via BOOTP.
1	DNS Client	Not supported
2	DHCP Client	Not supported
3	DHCP – DNS Update	Not Supported
4	Configuration Settable	1 (TRUE) indicates that the Interface Configuration attribute is settable. Some devices, for example a PC or workstation, may not allow the Interface Configuration to be set via the TCP/IP Interface Object.
5	Hardware Configurable	1 (TRUE) shall indicate the IP Address member of the Interface Configuration attribute can be obtained from hardware settings (e.g., pushwheel, thumbwheel, etc.). If this bit is FALSE the Status Instance Attribute (1), Interface Configuration Status field value shall never be 2 (The Interface Configuration attribute contains valid configuration, obtained from hardware settings).
6	Interface Configuration Change Requires Reset	1 (TRUE) shall indicate that the device requires a restart in order for a change to the Interface Configuration attribute to take effect. If this bit is FALSE a change in the Interface Configuration attribute will take effect immediately.
7-31	Reserved	Reserved for future use and shall be set to zero.

Table 12: TCP/IP Interface Objects – Attribute 02hex

2.3.3 Configuration Control Inst. Attribute (04hex)

	1		
Bit(s)	Called	Definition	
0-3	Startup Configuration	Determines how the device shall obtain its initial configuration at start up.	 0 = The device shall use the interface configuration values previously stored (for example, in non-volatile memory or via hardware switches, etc). 1 = The device shall obtain its interface configuration values via BOOTP. 2 = DHCP (Not supported) 3-15 = Reserved for future use.

Table 13: TCP/IP Interface Objects – Attribute 04hex

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2.3.4 Physical Link Object (05hex)

This attribute identifies the object associated with the underlying physical communication interface (e.g., an 802.3 interface). There are two components to the attribute: a path size (in UINTs) and a path. The path contains a logical segment type class, and a logical segment type instance that identifies the physical link object. The maximum path size is 6 (in the case of a 32-bit logical segment for each of the class and instance).

The physical link object itself typically maintains link-For example, the path could be as follows: specific counters as well as any link specific configuration attributes. If the CIP port associated with the TCP/IP Interface Object has an Ethernet physical layer, this attribute shall point to an instance of the Ethernet Link Object (class code = $F6_{hex}$). When there are multiple physical interfaces that correspond to the TCP/IP interface, this attribute shall either contain a Path Size of 0 or contain a path to the object representing an internal communications interface (often used in the case of an embedded switch).

Path	Meaning
0.2	[20] = 8-bit class segment type; [F6] = Ethernet Link Object class.
0-3	[24] = 8-bit instance segment type; [01] = instance 1.
Table	14: TCP/IP Interface Objects – Attribute 05hex

2.3.5 Interface Configuration (06hex)

Name	Meaning
	The IP address of the device. Value of 0 indicates that no IP address has been configured.
IP Address	Otherwise, the IP address shall be set to a valid Class A, B, or C address and shall not be
	set to the loopback address (127.0.0.1).
Network mask	The network mask of the device. The network mask is used when the IP network has been
	partitioned into subnets. The network mask is used to determine whether an IP address is
	located on another subnet. Value of 0 indicates no network mask address has been
	configured.
Table 15: TCP/IF	P Interface Objects – Attribute 06hex

2.3.6 Host Name

.

Name	Meaning
	ASCII characters. Maximum length is 64 characters. Shall be padded to an even number
Host Name	of characters (pad not included in length). A length of 0 shall indicate no Host Name is
	configured.

Table 16: TCP/IP Interface Objects - Host Name

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2.4 Ethernet Link Object

Class Code: F6hex

		1	1	1	1
Attribute ID	Access	Name	Data Type	Description	Semantics of Values
01 _{hex}	Get	Revision	UINT	Revision of this object	The minimum value is 1. Shall be 2 or greater if instance attribute 6 is implemented. Shall be 3 if any instance attributes 7- 10 are implemented. The maximum value is 3.
02 _{hex}	Get	Max Instance	UINT	Maximum instance number of an object currently created in this class level of the device	The largest instance number of a created object at this class hierarchy level
03 _{hex}	Get	Number of Instances	UINT	Number of object instances currently created at this class level of the device	The number of object instances at this class hierarchy level

Table 17: Ethernet Link Objects Overview

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2.4.0 Instance Attributes

ID	Access	Name	Data Type	Description of Attribute	Semantics of Values
	.			Interface speed currently	Speed in Mbps (e.g., 10, 100
1	1 Get	Interface Speed	UINT	in use	
2	Get	Interface Flags	DWORD	Interface status flags	See chapter 2.4.1
2	Cat	Physical	ARRAY of		Displayed format
3	Get	Address	6 USINTs	MAC layer address	"XX-XX-XX-XX-XX"
		Interface	OTDUCT	Contains counters	
		Countors	of	relevant to the receipt of	
		Counters	01.	packets in the interface.	
		In Octoba		Octets received on the	
		In Octets	UDINT	interface	
		In Llogat Dockata		Unicast packets received	
		III OCASI PACKEIS	UDINI	on the interface	
		In NUcast		Non-unicast packets	
		Packets	UDINT	received on the interface	
		In Discards	UDINT	Inbound packets received	
				on the interface but	
				discarded	
			UDINT	Inbound packets that	
4	Get	In Errors		contain errors (does not	
				include In Discards)	
				Inbound packets with	
		In Unknown	ODINI	unknown protocol	
		Out Octets	UDINT	Octets sent on the	
				interface	
		Out Ucast		Unicast packets sent on	
		Packets	ODINI	the interface	
		Out Uncast		Non-unicast packets sent	
		Packets	ODINI	on the interface	
		Out Discords		Outbound packets	
				discarded	
			דאוסוד	Outbound packets that	
				contain errors	

Table 18: Ethernet Link Objects – Instance Attributes

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ID	Access	Name	Data Type	Description of Attribute	Semantics of Values
		Media Counters	STRUCT of:	Media-specific counters	
		Alignment Errors	UDINT	Frames received that are not an integral number of octets in length	
		FCS Errors	UDINT	Frames received that do not pass the FCS check	
		Single Collisions	UDINT	Successfully transmitted frames which experienced exactly one collision	
		Multiple Collisions	UDINT	Successfully transmitted frames which experienced more than one collision	
		SQE Test Errors	UDINT	Number of times SQE test error message is generated	
5	Get	Deferred Transmissions	UDINT	Frames for which first transmission attempt is delayed because the medium is busy	
		Late Collisions	UDINT	Number of times a collision is detected later than 512 bit-times into the transmission of a packet	
		Excessive Collisions	UDINT	Frames for which transmission fails due to excessive collisions	
		MAC Transmit Errors	UDINT	Frames for which transmission fails due to an internal MAC sub layer transmit error	
		Carrier Sense Errors	UDINT	Times that the carrier sense condition was lost or never asserted when attempting to transmit a frame	
		Frame Too Long	UDINT	Frames received that exceed the maximum permitted frame size	
		MAC Receive Errors	UDINT	Frames for which reception on an interface fails due to an internal MAC sub layer receive error	
6		Interface Control	STRUCT of:	Configuration for physical interface	
		Control Bits	WORD	Interface Control Bits	See table below
	Set	Forced Interface Speed	UINT	Speed at which the interface shall be forced to operate	Speed in Mbps (10 or 100)

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ID	Access	Name	Data Type	Description of Attribute	Semantics of Values
7	Get	Interface Type	USINT	Type of interface	 1 = The interface is internal to the device, i.e. in the case of an embedded switch 2 = Twisted-pair (e.g. 100Base-TX)
8	Get	Interface State	USINT	Current state of the interface	0 = No link 1 = The interface is enabled and is ready to send and receive data
10	Get	Interface Label	SHORT_S TRING	Human readable identification	"Internal switch" or "External Port 1" or "External Port 2"
		Interface Capability	STRUCT of:	Indication of capabilities of the interface	
	Get	Capability Bits	WORD	Interface capabilities, other than speed/duplex	Bit map
		Speed/Duplex Options	STRUCT of:	Indicates speed/duplex pairs supported in the Interface Control attribute	
			USINT	Speed/Duplex Array Count	Number of elements
11			ARRAY of STRUCT of	Speed/Duplex Array	
			UINT	Interface Speed	Semantics are the same as the Forced Interface Speed in the Interface Control attribute: speed in Mbps
			USINT	Interface Duplex Mode	0=half duplex 1=full duplex 2-255=Reserved
14	Get	Ethernet Error	UDINT	Sum of certain error counts that are and 13	e part of attributes 4, 5
15	Get	Link Down Counter	UDINT	Counts the number of times a Link was detected on this port	Down transition event

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Control Bits

Control	DILS	
Bit(s)	Called	Definition
0	Auto-negotiate	802.3 link Auto-negotiation: 0 = disabled, 1 = enabled (standard) If Auto-negotiation is disabled, then the device shall use the settings indicated by the Forced Duplex Mode and Forced Interface Speed bits.
1	Forced Duplex Mode	If Auto-negotiation bit = 0 the Forced Duplex Mode bit indicates whether the interface shall operate in full or half duplex mode. 0 = Half Duplex, 1 = Full Duplex
2-15	Reserved	Shall be set to zero

Table 19: Ethernet Link Objects – Control Bits

Example

Use on Transmit data size double (4 bytes) 00000064

for Auto-negotiation = disable on 100 MBaud

POSITAL

2.4.1 Interface Flags

2.4.1 Int	erface Flags	
Bit(s)	Called	Definition
0	Link Status	Indicates whether the Ethernet 802.3 communications interface is connected to an active network. 0 indicates an inactive link; 1 indicates an active link. The determination of link status is specific to the implementation. In some cases, devices can tell whether the link is active via hardware/driver support. In other cases, the device may only be able to tell whether the link is active if it receives incoming packets.
1	Half/Full Duplex	Indicates whether the duplex mode is currently in use. 0 indicates the interface is running half duplex; 1 indicates full duplex. Note that if the Link Status flag is 0, then the value of the Half/Full Duplex flag is not determinate.
2-4	Negotiation Status	 Indicates the status of link auto-negotiation: 0 = Auto-negotiation in progress. 1 = Auto-negotiation and speed detection failed. Using default values for speed and duplex. Default values are product-dependent; recommended defaults are 10Mbps and half duplex. 2 = Auto negotiation failed but detected speed. The duplex was defaulted. Default value is product-dependent; recommended default is half duplex. 3 = Successfully negotiated speed and duplex. 4 = Auto-negotiation not attempted. Forced speed and duplex.
5	Manual Setting Requires Reset	0 indicates that the interface can perform changes to link parameters (auto- negotiate, duplex mode, interface speed) automatically. 1 indicates that the device requires a Reset service to be issued to its Identity Object for the changes to be effective.
6	Local Hardware Fault	0 indicates the interface detects no local hardware fault; 1 indicates a local hardware fault is detected. The meaning of this is product specific. For example, an AUI/MII interface can detect that no transceiver is plugged, or a radio modem can detect that no antennae plugged. In contrast to the soft, possible self-correcting nature of the Link Status being inactive, this concerns major issues requiring the intervention of the user.
7	Reserved	Shall be set to zero

Table 20: Ethernet Link Objects – Interface Flags

2.4.2 Common Services

Service Code	Class	Instance*	Service Name	Description of Service
0E _{hex}	Condit ional	Required	Get_Attribute_Single	Returns the contents of the specified attribute
10 _{hex} Table 21: Ethe	n/a ernet Link	Conditional Objects – Co	Set_Attribute_Single mmon Services	Modifies a single attribute

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2.4.3 Link Object Instances

Instance	Description
1	Internal interface
2	Intern switch Port 1
3	Intern switch Port 2
T-1-1- 00-1 :1-	Object les teners

Table 22: Link Object Instances

2.5 Setting parameters with scanners

Several external scanners exist for EtherNet/IP available. RS-NetWorxTM has one such scanner. In the figure you can see an example where the

IP address (192.168.1.70) is read out of the encoder.



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2.5.1 Read out position value

Get Single Attribute Position sensor value: Class: 0x23 (Position sensor object) Instance: 0x01 Attribute: 0x03 (Position Value)

Sclass Instance Editor - [Node 192.]	.68.1.70]
Execute Transaction Arguments Service Code Value Description E Get Single Attribute	Object Address Class: Instance: Attribute: [23] [1] [3] Image: Send the attribute ID []
Transmit data size: Data	sent to the device:
Receive Data Output size format: Data receive Byte Utput radix format:	ed from the device:
Hexadecimal	T Qose Help

2.5.2 Set preset value

Set Single Attribute Position Preset Value to 1Class: 0x23(Position sensor object)Instance: 0x01Attribute: 0x13(Preset Value)

🕞 Class Instance Editor - [Node 192.168.1.70]
Service Code Object Address Value Description 10 Set Single Attribute Transmit data size: Data sent to the device: Double (4 bytes) Image: Comparison of the stribute Values in decimal Execute
Receive Data Output size format: Word (2 bytes) Output radix format: Decimal
QloseHelp

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2.5.3 Get preset value

Get Single Attribute Position Value Class: 0x23 (Position sensor object) Instance: 0x01 Attribute: 0x13 (Preset Value)

🖓 Class Instance Editor - [Node 192.168.1.70]	P	23
Service Code Object Address Value Description E Get Single Attribute Service Code Object Address	Attribute:	
Iransmit data size: Data sent to the device: Double (4 bytes) Image: Comparison of the device of th	Execute	
Receive Data Output size format: Double (4 bytes) Output radix format: Decimal		*
Qose	Hel	p

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3 Diagnostics

Color	EtherNet/IP name	Description
<mark>Yellow</mark>	Notwork Status Indicator 1	Details in Table 24
Green	Network Status Indicator 1	
<mark>Yellow</mark>	Notwork Status Indiantar 2	Details in Table 24
Green	Network Status Indicator 2	
Green	Madula Otatua Indiantan	Details in Table 23
Red	Module Status Indicator	
	Color Yellow Green Yellow Green Green	ColorEtherNet/IP nameYellowNetwork Status Indicator 1GreenNetwork Status Indicator 2GreenNetwork Status Indicator 2GreenModule Status Indicator



Figure 6: Diagnostic LEDs

LED		Summary	Requirements
Steady Off	\bigcirc	No power	
Steady On	<u> </u>	Device	If the device is operating correctly, the module status indicator shall
Green	7444	operational	be steady green
Flashing	*	Standby	If the device has not been configured (e.g. the IP-Address) the
Green 1	\sim		module status indicator shall be flashing green with 1 Hz
Flashing	***	Missing IP	If the device does not have an IP-Address, the module status
Green 2	*		indicator shall be flashing green with 4 Hz
Flashing		Minor fault	If the device has detected a recoverable minor fault e.g. an
Red			incorrect or inconsistent configuration, the module will be flashing
			red
Steady On	****	Major fault	Happens when the device has detected a non-recoverable major
Red	Zwit		fault
Flashing	X	Self-test	While the device is performing its power up testing, the Stat1 and
Red + Green	~ ~ ~		Stat2 LED shall be flashing red / green

Table 23: Module Status Indicator Stat1/Stat2

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		Summers	Beguiremente
LED		Summary	Requirements
Steady Off	***	No power, no IP	If the device does not have an IP address or is powered off
	3WL	address	
Steady	**	Connected	If the device has at least one established connection (even to the
Green	****		Message router)
Flashing	*	No connection	If the device has no established connections, but has obtained
Green	\sim		an IP address
Flashing		Connection	If the target of one or more of the connections in which this device
Yellow		timeout	is has timed out. This shall be left only if all timed-out connections
	v v		are reestablished or if the device is reset
Steady	****	Duplicate IP	If the device has detected that the IP address is already in use
Yellow	- W		
Flashing	*	Self-test	While the device is performing its power up testing, the Stat1 and
Yellow / Gree	n		Stat2 LED shall be flashing yellow / green

Table 24: Network Status Indicator Stat2

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4 Programmable Parameters

4.1 Direction Counting

This operating parameter can be used to select the code sequence. The parameter can be set via

Configuration Assembly and Explicit Messaging.

Attribute ID	Default value	Value range	Data Type		
0Chex	Ohex	Ohex - 1hex	Boolean		
Table 25: Direction Counting					

The parameter code sequence (complement) defines the counting direction of the process value **as seen from the shaft** (clockwise or counterclockwise). The counting direction is defined in the attribute 0C_{hex}:

4.2 Scaling Function Control

If the Scaling function control is deactivated, then

the output value is the physical resolution.

Attribute ID	Default value	Value range	Data Type		
0Ehex	Ohex	Ohex - 1hex	Boolean		
Table 27: Scaling Function Control					

This parameter can be set via Configuration Assembly and Explicit Messaging

4.3	Resolution	per	Revolution	

The parameter resolution per revolution is used to program the encoder to a desired number of steps per revolution. Each value between 1 and the maximum (see type label) can be realized. The

Bit 0	Scaling function on/off
0	OFF
1	ON

Table 28: Scaling Function Control Bits

parameter can be set via Configuration Assembly and Explicit Messaging. Scaling function control **must be switched on**!

Attribute ID	Default value	Value range	Data Type
10 _{hex}	(*)	0hex - 10000hex	Double Integer 32
Table 29: Resolution	per Revolution		

(*) see type label, maximum resolution:

16Bit Encoder: 10,000hex (65,536)

If the value is set to a value larger than 8,192 for a 13-bits encoder, it will lead to values being skipped while rotating the shaft.

Therefore, it is recommended to keep the measuring steps per revolution below 8,192 measuring steps.

Unex	Un
: Direction Countin	na
	.9

Bit 0Counting directionPosition values0CWIncrease1CCWDecrease

Table 26: Direction Counting Bits

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4.4 Total Resolution

This value is used to program the desired number of measuring steps over the total measuring range. This value must not exceed the total resolution of the encoder. E.g. with 25-bits = 33,554,432 steps. Please note the value written on the type label. The parameter can be set via Configuration Assembly and Explicit Messaging. Scaling function control **must be switched on**!

Attribute ID	Default value	Value range	Data Type
11 _{hex}	(*)	0 _{hex} - 40,000,000 _{hex}	Unsigned Integer 32
Table 30: Total Resoluti	ion		

(*) see type labelMaximum total resolution30 bits encoder: 40,000,000_{hex} (1,073,741,824)

If the Resolution per Revolution has been changed (see 4.1.3), the Total Resolution must be adapted

accordingly. The total resolution must follow the equation:

Total Resolution = Number of Turns x Resolution per Revolution

4.5 Preset Value

The preset value is the desired position value, which should be reached at a certain physical position of the axis. The position value of the encoder is set to the desired value by the preset parameter. The preset value must not exceed the total measuring range. The parameter can be set via Explicit Messaging.

Set the preset value only in standstill!

Attribute ID	Default value	Value range	Data Type
13 _{hex}	Ohex	0 _{hex} - total measuring range	Unsigned Integer 32

Table 31: Preset Value

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4.6 Velocity Format

The default value for Velocity Format is steps per second. This parameter can be set via Con-

figuration Assembly or Explicit Messaging.

Attribute ID	Default value	Value range	Data length
19 _{hex}	1F04 _{hex}	0800hex	Steps per 10 milliseconds
		0801 _{hex}	Steps per 100 milliseconds
		1F04 _{hex}	Steps per 1 second
		1F05 _{hex}	Steps per 1 millisecond
		1F06 _{hex}	Steps per 1 microsecond
		1F07 _{hex}	Steps per minute
		1F0E _{hex}	RPS (revolutions per second)
		1F0F _{hex}	RPM (revolutions per minute)

Table 32: Velocity Format

4.7 Velocity Filter

To increase the accuracy of the velocity in the application, it is possible to switch between three different filtering types of the exponential moving average. Default: Fine.

 Attribute ID
 Default value
 Value range
 Description
 Data Type

 70_{hex}
 0_{hex}
 0_{hex} / 1_{hex} / 2_{hex}
 0 = Fine, 1 = Normal, 2 = Coarse
 Double Integer

 Table 33: Velocity Filter

Ratio between old and current speed: Fine: 7:3, Normal: 96:4, Rough: 996:4

4.8 Endless Shaft

It is important that the ratio "Total resolution" / "measuring units per revolution" remains a multiple of the total number of turns. For example, for a 12-bit revolutions encoder, the ratio must remain a multiple of 4,096:

Total Resolution / Measuring Units per Revolution = n x 4,096

Where n is an integer

However, the Endless Shaft functionality of POSITAL's	any drops in the position (see pictures here after).
EtherNet/IP encoders can solve the problem directly.	The Endless Shaft functionality must however be
It will check whether <i>n</i> is an integer (see equation here	enabled.
above).	Default value: Auto.
If not, it will run calculous to make sure we do not see	Can be set only via Explicit Messaging.

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Figure 7: Endless Shaft

Note: The internal software routine only works if the encoder is in operation. If it is necessary to turn the encoder shaft more than 1,024 revolutions without

power supply this can lead to problems (the internal routine will not work without power supply). Therefore, the rule ahead should be observed for new devices.

Attribute ID	Default value	Value range	Description	Data Type
65 _{hex}	2 _{hex}	Ohex / 1hex / 2hex	0 = Off, 1 = On, 2 = Auto	Double Integer
Table 34: Endl	ess Shaft			

4.9 Parameter Control Priority

This parameter determines if the configuration parameters should be loaded from the Configuration Assembly or from the Non-Volatile Data.

Attribute ID	Default value	Value range	Description	Data Type
71 _{hex}	Ohex	O _{hex} / 1 _{hex}	0 = Configuration Assembly, 1 = Non-Volatile Memory	Double Integer

Table 35: Parameter Control Priority

4.10 Available Alarms and Warnings

Attributes 44 (2Chex) and 47 (2Fhex) respectively indicate alarms and warnings for the following parameters:

- Position error (alarm attribute): indicates that the internal position self-test failed
- Diagnostic error (alarm attribute): indicates that a malfunction has occurred that can lead to an incorrect position
- Temperature exceeded (warning attribute): indicates that the temperature has exceeded the defined threshold (85°C)

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Attribute ID	Default value	Value range	Description	Data Type
			Bit 0: Position error	
2C _{hex}	0	0. / 1.	Bit 1: Diagnostic error	WORD
	Unex / Thex	Uhex / Thex	Bit 2-15: Reserved	
			0 = No, 1 = Yes	

Table 36: Alarms

Attribute ID	Default value	Value range	Description	Data Type
			Bit 0-12: Reserved	
2F _{hex}	Ohex	Ohex / 1hex	Bit 13: Temperature warning	WORD
			0 = No, 1 = Yes	

Table 37: Warnings

4.11 Device Level Ring

The DLR protocol is intended to support simple ring topologies requiring fast recovery from network failures.

A DLR network consists of an active Ring Supervisor and any number of Ring Nodes. Ring nodes

incorporate embedded switch technology with at least two external ports. This allows the data to be rerouted backwards to the other devices on the ring, should a failure occur.



Figure 8: Device level Ring

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5. Installation

5.1 Electrical connection

The rotary encoder is connected by a 4 pin M12 connector for the power supply and two 4 pins, D-coded M12 connectors for Ethernet

Connector Ethernet

4 pin female, D-coded

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

Table 38: Data Pin Assignment



Figure 9: Ethernet Connector

5.2 Ethernet cables 5.2.1 RJ45 – M12 crossed

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

Table 40: Ethernet cable RJ45-M12 crossed

5.2.2 RJ45 - M12 straight

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

Table 42: Ethernet cable RJ45-M12 straight

communication.

The encoder uses a second D-coded connector and provides integrated switch functionality.

Connector power supply

4 pin male, A-coded

Pin Number	Signal
1	US (10 - 30 V DC)
2	N.C.
3	GND (0V)
1	NC

4 | N.C. Table 39: Power Supply Pin Assignment



Figure 10: Power Supply Connector

5.2.3 M12 - M12 straight

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

Table 41: Ethernet cable M12-M12 crossed

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6 Power On

After power on the LEDs on the absolute rotary encoder will flash between green and red or yellow.

7 Installation

7.1 Rockwell configuration tools

7.1.1 Setting IP-Address (BOOTP)

To set the IP Address there are special tools available. I.e. the BOOTP Server is installed with the software package from RSNetWorx[™]. The server scans the network for the MAC Addresses of all products with active BOOTP. If one MAC address is selected in the Request History then the IP Address can be set by the "Add to Relation List" button. The MAC Address of each EtherNet/IP encoder is available on the type label. Note: After a power up the encoder send the BOOTP request again. But after several times

If the encoder already has an IP-Address, the BOOTP must be disabled. Otherwise, the encoder will ask for a new IP-Address again. After setting the IP-Address the Status LED is flashing with 1 Hz. In this case, save the configuration in the File menu, because the products cannot be found by

with no answer the frequency of requests decreases. A power up after a long pause could solve the missing requests.

If you cannot find all the encoders within the BOOTP Server list then check the following points:

- LED status of the encoder OK?
- Is the Network correctly set?
- Is the BOOTP enabled?

the BOOTP Server. After loading this file, the MAC Address and IP-Address are available and BOOTP can be deactivated by the corresponding button. Possible IP-Range:

Class A-C (0.0.0.0 - 223.255.255.255) without Loopback range (127.x.x.x)

Referenced IP-Address range: 192.168.0.x

BOOTP/DHCP Server 2.3 - E:\bootp.bpc	
Elle Tools Help	
Request History	
Clear History Add to Relation List	New Entry
(hr:min:sec) Type Ethernet Address (MAC) IP Address Host	name
15:41:04 BOOTP 00:0E:CF:03:10:27	Ethernet Address (MAC): 00:0E:CF:03:10:27
15:40:32 BOOTP 00:0E:CF:03:10:27	IP Address: 192 . 168 . 0 . 252
15:40:09 BOOTP 00:0E:CF:03:10:27 15:40:06 BOOTP 00:0E:CF:03:10:27	Hostname:
13.40.00 BOOTT 00.0E.CI.03.10.27	Description:
	OK Cancel
□ Relation List	
New Delete Enable BOOTP Enable DHCP Disable BOOTP/DHCP	
Ethemet Address (MAC) Type IP Address Hostnar Force select	ed device to retain configuration in memo
00:0E:CF:03:10:27 BOOTP 192.168.0.252	
Status	Entries
Save file complete	1 of 256

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57	BOOTP/DHC	P Server	2.3			
Eile	e <u>T</u> ools <u>H</u> elp					
F	Request History-					
	Clear History	Add to	Relation List			
	(hr:min:sec)	Туре	Ethernet Address (MAC)	IP Address	Hostname	
	15:41:04	BOOTP	00:0E:CF:03:10:27	192.168.0.252		
	15:40:17	BOOTP	00:0E:CF:03:10:27			
	15:40:09	BOOTP	00:0E:CF:03:10:27			
	10.40.00	00011	00.02.01.00.10.21			
F	elation List					
	New Delete	e Enabl	e BOOTP Enable DHCP	Disable BOOTP/DHCP		
	Ethernet Addre	ss (MAC)	Type IP Address	 s Hostname	Description	
	00:0E:CF:03:10):27	BOOTP 192.168.0	.252		
	itatus					Entries
	-catolo					Entitos

After setting the IP-Address with this tool the IP-Address will be available only after the next BOOTP request. If the IP-Address is not known and BOOTP is deactivated it is possible with the tool named Wireshark to find the IP-Address.

NOTE:

Alternatively, for the encoders with 3 rotary switches, the IP address can be set directly via the rotary switches present on the connection cap.

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IP address	Meaning
888	- The encoder gets its IP address from a BOOTP Server and saves
	the TCP parameters in non-volatile memory.
	- BOOTP is always activated and cannot deactivate via server.
	- The encoder is not allowed to send confirmation that BOOTP is deactivated!
	- After each Power-up the encoder needs the IP configuration again!
	- This is the emergency configuration, if the IP address is not known
	for activating BOOTP.
0, 255-887,	- On activated BOOTP the encoder gets its IP address and the other
889-999	TCP parameters from a BOOTP server.
	- On deactivated BOOTP the encoder uses the IP address from non-volatile memory.
	- The encoder sends a confirmation that BOOTP is deactivated
001 – 254	Allowed ranged of configurable IP addresses for xxx
192.168.1.xxx	Fixed address range*
255.255.255.0	Fixed subnet mask*
0.0.0.0	Fixed gateway address*

Table 43: Rotary Switches Allowed IP Addresses

* can be modified



Figure 11: IP Address Rotary Switches

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7.1.2 Configuration RSLinx Classic™

RSLinx[™] is a complete communication server providing plant-floor device connectivity for a wide variety of Rockwell Software applications such as RSLogix[™], RSNetWorx[™],...

To start a new project add first a new RSLinx Classic[™] Driver for EtherNet/IP under *Communications Configuration Drivers* and input the name.

Configure Drivers		? 🛛
Available Driver Types:		Close
RS-232 DF1 devices Ethernet devices Ethernet/IP Driver 1784-KT/KTX(D)/PKTX(D)/PCMK for DH+/DH-485 devices 1784-KT(X) for ControlNet devices DF1 Polling Master Driver 1784-PCIC for ControlNet devices 1784-PCIC(S) for ControlNet devices 1784-PCIC(S) for ControlNet devices 1747-PIC / AIC+ Driver DF1 Slave Driver S-S SD/SD2 for DH+ devices Virtual Backplane (SoftLogix58xx) DeviceNet Drivers (1784-PCD/PCIDS,1770-KFD,SDNPT drivers) PLC-5 (DH+) Emulator driver SoftLogix5 driver Remote Devices via Linx Gateway	Add New	Configure Configure Startup Start Stop Delete

Add New RSLinx Classic Driver	
Choose a name for the new driver. (15 characters maximum)	ОК
OCD_NET	Cancel



Use *Browse Local Subnet* to find the EtherNet/IP components in the network. The status should be

Configure driver: OCD_NET	(? 🗙
Ethemet/IP Settings		
Browse Local Subnet	C Browse Remote Subnet	
IP Address:	· · ·	
Subnet Mask:	· · ·	
	Abbrechen Obernehmen Hill	
OK	Abbrechen ugernehmen Hill	e

"Running". Then push the *Close* button to finish this configuration.

Configure Drivers		? 🔀
Available Driver Types: Ethernet/IP Driver Configured Drivers:	▼ <u>A</u> dd New	<u>C</u> lose <u>H</u> elp
Name and Description OCD_NET_A-B Ethernet_RUNNING	Status Running	Configure Startup Start Stop Delete

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7.1.3 RSNetWorx™

RSNetWorx[™] products provide design and configuration management services for EtherNet/IP. The program defines and configures the devices on the network quickly through a

EDS Wizard

The EDS File contains information about device specific parameters as well as possible operating modes of the encoder. With this file you have a data sheet in an electronic format, which can be used to configure the device in the network, for example with RSNetWorx[™] from Rockwell. In this sample the PLC uses address 192.168.0.100 and the encoder 192.100.0.252.

To install the EDS file the EDS Wizard has to be

simple software interface. This definition can take place offline using drag and drop operations or online by using RSLinx® to browse an EtherNet/IP network.

started, that can be done in the menu *Tools/EDS Wizard*. If the EDS Wizard is activated successfully the *Register an EDS File(s)* has to be chosen and after that the button *weiter*. In the next step the *Register a directory of EDS files* has to be chosen and with *Browse* the path of the EDS file(s). That is indicated in the next pictures.



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The Wizard finds all EDS files that are discarded





in the choosing path and operates a test to check the EDS files on errors. In the next step pictures can be selected for the using nodes. With the button *waiter* the installation can be continued and finished.





Load a saved *.enet file or start a new project. Add the devices per Drag and Drop to the network Line and set the IP-Address

Optionally, browse the network with all devices with Button 👯 or *Upload from Network*. It

Browse for Network
The current path is not valid for the communication drivers on this computer. Select a communications path to the desired network.
Autobrowse Refresh
□
K

is not necessary to set the IP-Address manually. To use this configuration in RSLogix save the *.enet file.



7.1.4. Configuration RSLogix 5000

The RSLogix 5000 Series environment offers an easy-to-use, IEC61131-3 compliant interface, symbolic programming with structures and arrays, and a comprehensive instruction set that serves

many types of applications. It supports relay ladder, structured text, function block diagram, and sequential function chart editors for you to develop application programs.

1. Create a New Project



2. Choose your PLC in the available list

New Controller			×
Vendor:	Allen-Bradley		
Туре:	1769-L23E-QBFC1 CompactLogix5323E-QBFC1 Controller	•	OK
Revision:	20 🗸		Cancel
	Redundancy Enabled		Help
Name:			
Description:			
Changia Turan			
chassis type:	<none></none>	-	
Slot:	0 Safety Partner Slot: <none></none>		
Create In:	C:\Program Files (x86)\Rockwell Software\RSLogix 5000\ENU\v20\Bin		Browse
Security Authority:	No Protection	•	
	Use only the selected Security Authority for Authentication and		
	Authorization		
		_	

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 Look for the connection path to the encoder (1) In the pop-up window (2) Select the encoder (3) and Click on Go Online (4).



Click on **Download** The empty program will be loaded to the PLC.
 A connection is established.



5. Go **Offline** (necessary to perform changes in the configuration)



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Add the EDS file Click on EDS Hardware Installation Tool Next -> Register an EDS -> Next -> Browse to the EDS file location -> Next -> OK



7. Add a new module



8. Look for your encoder



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⁽¹⁾ You can change the Input Assembly later by Going **Offline** -> Changing the **Input Assembly** (in the same window) -> **Download** on the PLC

USER MANUAL



13. In the Controller Tags window, you can see Position and Velocity

14. In the **Controller Tags** Window, you can set the following parameters: DirectionCountingToogle, ScalingFunctionControl, MeasuringUnitPerSpan,TotalMeasuringRange,VelocityFormat, VelocityFilter,PrmCtrlPriority

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15. You can see Acceleration, Temperature and Warning Flags by selecting the Input Assembly 121 as instance (see po 10 and note ⁽¹⁾)

The values of the different Bytes are then visible in the Controller Tags window

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16. Set Preset

In the Controller Tags wndow, Create the following tags:

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Name	224	Also For	See Tag	Data Type	Description	Ereme Access	Constant	Style	
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Create the follo	wing Main Routine	
Click on View	Configuration	
Control Control Contr	ent i melon loof i loof i i i i i i i i i i i i i i i i i i	

In the Configuration Tab, set Service Type, Code, Class, Attribute, Instance, Source Element and Length as below:

Configuration* Communication Tag		
Message <u>Type</u> : CIP Generic	•	
Service Type: Service Code: Instance: Set Attribute Single (Hex) Class: Instance: I Attribute: I (Hex)	<u>S</u> ource Element: Source L <u>e</u> ngth: Destination Element:	Preset_Value (Bytes) New Tag
Enable Enable Waiting Start Error Code: Extended Error Code: Error Path: Error Text:	O Done D	one Length: 0] Timed Out ←

In the **Communication** tab, **Browse** (1) for the encoder (2) Click on **Apply** and **OK Download** the configuration

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nfiguration" Communication Tag	Message Path Browser
@ Path:	Pairc Encoder
Broadcast:	Encoder
Communication Method	E-😂 1/0 Contiguration
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r Path: r Text:	DK Careal Help

In the Controller Tags window:

- 1. Set the *Preset_value* as desired
- 2. Set Preset_start to "1"
- 3. See value changed. Please note that Preset_start is back to "0"

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17. Set Auto-negotiate and Half/Full Duplex Mode Define **User Type** as follows:

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Name:	Interface_Control					
Description:			~			
			Ŧ			
Members:		Data Type Size: 4 byte	e(s)			
Name		Data Type	Style	Description	External Access	
Control_Bits		INT	Decimal		Read/Write]
Forced_Interface_Speed		INT	Decimal		Read/Write	1
		·				_

Create the following Ladder Program:

1	Interface_Ctrl_Set Interface_Ctrl_ONS	MSG	

You can now change the parameters in the Controller Tags window

_		-			
	- Interface_Ctrl	{}	{}		Interface_Control
	Interface_Ctrl.Control_Bits	1		Decimal	INT
	Interface_Ctrl.Forced_Interface_Speed	0		Decimal	INT
	Horeface_Ctrl_Msg	{}	{}		MESSAGE
	Interface_Ctrl_ONS	1		Decimal	BOOL
	Interface_Ctrl_Set	1		Decimal	BOOL

7.1.4.1. Generic Module Configuration

1. Add the Generic Module in the project

Type: Vendor: Parent:	ETHERNET-MODULE Generic Ethem Rockwell Automation/Allen-Bradley Local	et Module			
Name:	Encoder	Connection Para	Assembly		
Description:	^	Input:	Instance:	Size:	(32-bit)
	· · ·	Output:	105		Intell Constants
Comm Format	Input Data - DINT ~	Configuration:	106	12	(8-bit)
IP Addre	es: 192 . 168 . 0 . 211	<u>Status Input</u>			
O Host Na	me:	Status Output			

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Additional settings are needed when configuring the Generic Module.

You need to make the settings like in image 2 in Controller Tags -> Monitor Tags window, inside the module you created. In this test it is Encoder:C.

The values for the parameters Encoder:C.Data[0] ... Encoder:C.Data[11] need to be entered manually in "Value" column.

Name	22 ×	Value +	Force Mask	 Style 	Data Type	Description
# Encoder:C		{}	6-	1	AB ETHERN.	
# EncodenC.Data		{·}	6-	.) Hes	SINT[400]	
Encoder(C.Data[0]		15#00		Hei	SNT	Direction Counting Toggle
Encoder:C.Data[1]		15#01		Hei	SNT	Scaling Function Control
Encoder:C.Data[2]		16#e8		Her	SINT	Measuring Units per Span byte 0 (LSB)
Encoder:C.Data[3]		16#03		Hex	SNT	Measuring Units oer Span byte 1
Encoder:C.Data[4]		16#00		Hes	SINT	Messuring Units per Span byte 2
Encoder:C.Data[5]		16#00		Hex	SNT	Measuring Units per Span byte 3 (MSB)
Encoder:C.Data(6)		16#1d		Hex	SNT	Total Measuring byte 0 (LSB)
Encoder:C.Data[7]		16#09		Hex	SINT	Total Measuring byte 1
Encoder:C.Data[8]		15#00		Hex	SINT	Total Measuing byte 2
Encoder(C.Data(9))		15#00		Hes	SINT	Total Measuring byte 3 (MS8)
Encoder/C.Data[10]		16=04		Hex	SINT	Velocity 0 (LSB)
Encoder:C.Data[11]		16#16		Hei	SINT	Velocity 1 (MS8)

In the "Description" column, there is the description of the generic data values added. This setting imitates the parameters that are contained in a regular EDS fil

7.2 VLAN Configuration over a Layer 3 Switch

Some applications require the use of a Layer 3 Switch. When this switch is placed between the encoder and the PLC, these ones will be in different subnets. POSITAL's Ethernet/IP encoders support the VLAN functionality. In order to be able to establich a connection between the PLC and the encoder, you have to make sure that the encoder and PLC are set as VLAN-Members of the same VLAN group (see setup below).

Note: only available in Unicast.

Connections:

Port 1	PC with RSLinx Classic and RSLogix 5000	IP 192.168.1.99
Port 3	PLC	IP 192.168.1.100
Port 5	ETAP	IP 192.168.100.50
Port 6	Encoder	IP 192.168.100.70

Table 44: Example of VLAN IP Addresses Allocation

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Figure 12: Example of VLAN Setup 8 FAQ

- 8.1 Problem: I replaced a rotary encoder in the machine and now the controller cannot start the application. Additionally, the Stat LED is flashing at 4 Hz (4 flashes per second).
 Solution: Start the BOOTP server to set the IP-Address and deactivate BOOTP. See chapter 7.1.1
- 8.2 **Problem:** Cannot deactivate BOOTP.

Background: Firewall and/or WLAN block communication.

- Solutions:
- 1. Firewall must not block Port 67 and 68
- 2. Deactivate WLAN and all other network cards.
- 8.3 Problem: Error message "Invalid identifier"Solution: Check that the major revision of the encoder uses the same number as the EDS file. Check the website.

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8.4 Problem: Stat LED is flashing with 4 Hz Background: After replacing a rotary encoder in the machine, the controller cannot start the application. Additionally, the Stat LED is flashing with 4 Hz Solution: Start the BOOTP server to set the IP address and deactivate BOOTP.

8.5 Problem: After Power-up the programmed parameters are lost. Solution: Use the save command to save all programmed parameters in the non-volatile memory (NVM). Only Preset is saved automatically in the NVM.

8.6 Problem: Parameters from Configuration tool like RSLogix overwrite the saved values of the encoder

Answer: Yes, that is how it is supposed to work. Please refer to FAQ 8.6 to have the parameters saved on the configuration tool.

8.7 Problem: How many encoders can work with one Rockwell PLC?

Answer: One encoder represents a traffic of only 100 Ethernet packets per second. The PLCs can manage 6,000-20,000 Ethernet packets/s. Rockwell has got two tools:

- EtherNet/IP Capacity Tool
- Integrated Architecture Builder (overdressed for analysis)
- 8.8 Problem: Rockwell PLC get error code 515 from our encoder

Answer:

- 1. Check if its cable installation was done correctly
- 2. Check if the network load is not too big. If so, you can use a Unicast instead of Multicast configuration.
- 3. If the PLC has not worked before with one of our encoders,
- You can download and test our sample project from our website.
- **8.9 Problem**: What is the fastest possible cycle time (RPI) on our EtherNet/IP encoder? **Answer**: 1ms.

8.10 Problem: How can one set the preset value from the Control Tag Table?Answer: You can download our quick start manual (under the Tool.zip folder of the product page) from our website and investigate the slides for detailed information.

8.11 Question: What is the default IP address of the encoder? Answer: 192.168.0.250

8.12 Question: Is the new encoder version OCD-EEC1B backward compatible with the old version OCD-EEA1B?

Answer: We can only guarantee that the encoder is 100% backward compatible when an EDS file is used. When application engineers are using their own direct connections to the attributes, they can in some cases run into the problem that some attributes aren't one-to-one set the same.

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9 Glossary

9 Glossary	
Term	Explanation
10Base-T	Transmission line with 10 Mbit data transmission rate
100Base-T	Transmission line with 100 Mbit data transmission rate
Auto-crossing	Allow to use straight or crossover wiring
Auto-negotiation	Is an Ethernet procedure by which two connected devices choose common transmission parameters, such as speed and duplex mode
Baudrate	Transmission rate: it displays the transmission bits per second
Big Endian	Variables will use Byte 0 as Low and last Byte as High
Binary	Numeric system with value 0 or 1.
BOOTP	A UDP network protocol used by a network client to obtain its IP address automatically
CAT5	Terminations for transmission rates up to 100 Mbit.
CIP	Control and Information Protocol
DHCP	Dynamic Host Configuration Protocol is a protocol used by network devices (clients) to obtain the parameters necessary to operate in an Internet Protocol network. This protocol reduces system administration workload, allowing devices to be added to the network with little or no manual configuration.
DLR	Device Level Ring
EIP	EtheNet/IP
EMC	Electromagnetic compatibility, there are rules to verifying devices.
ENIP	EtherNet/IP
Ethernet	Ethernet is a computer network technology based on frames.
Explicit Messages	Communication between an Ethernet scanner and an encoder (in our case)
Fast Ethernet	Transmission technology with 100 Mbit transmission rate.
Flash	Internal memory, saved data will be available after a power cycle.
Implicit Messaging	IO Connection: communication between a controller and the device
IP Address	Allow a logic addressing of devices in a network.
IP Protocol	The Internet P rotocol is widespread in computer networks. It is the implementation of the internet layer of the TCP/IP model
MAC Address	Worldwide explicit address of a device. The encoder uses three MAC Addresses: one for internal interface and two for the ports.
Mbit	Transmission rate or baud rate, million bits per second
OCD	Acronym: O PTO C O D E, name of an encoder series manufactured by FRABA POSITAL.
OSI Model	The O pen S ystem Interconnection reference model is an open layer model for the organization of a communication.
Scanner	Program to send Explicit Messages to the encoder
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.

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TCP	The Transmission Control Protocol is a connection orientated transmission
	protocol, in a network.
UDP	User Datagram Protocol is utilized to send data that does not need to be
	transferred in a reliable way.
Table AF. Olassas	

Table 45: Glossary

We do not assume responsibility for technical inaccuracies or omissions. Specifications are subject to change without notice.

10 Revision index

Revision	Date	Revision
First release	2020-08-09	1.0
General small updates	2020-09-18	1.1
Tutorial RSLogix; Tables and Figures Indexes; 7.4. VLAN	2020-12-02	1.2
DHCP Information	2024-07-25	1.3
Table 46: Revision Index		-