ABSOLUTE IXARC ROTARY ENCODER WITH ETHERNET/IP INTERFACE

USER MANUAL

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USER MANUAL

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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)

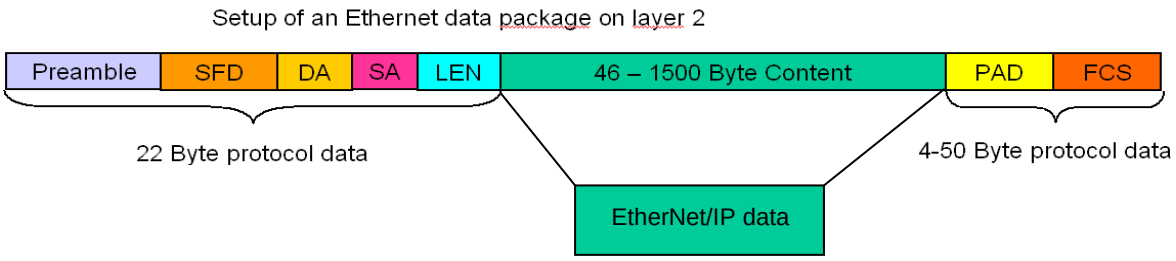


Figure 1: Setup of an Ethernet Data Package on Layer 2

1.1 Control and Information Protocol (CIP)

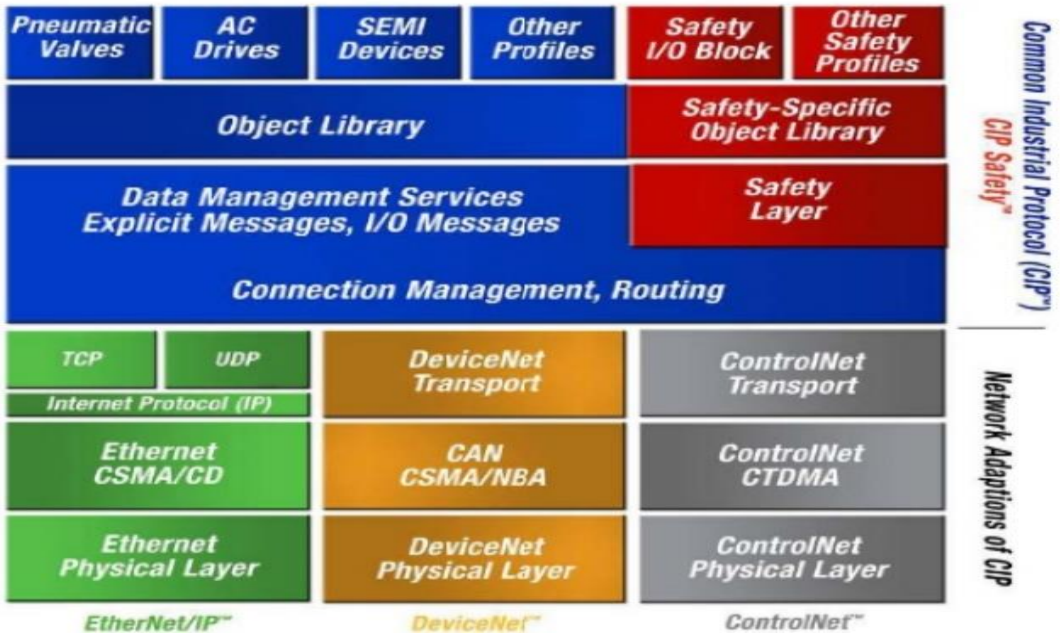


Figure 2: CIP OSI Layers

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

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.

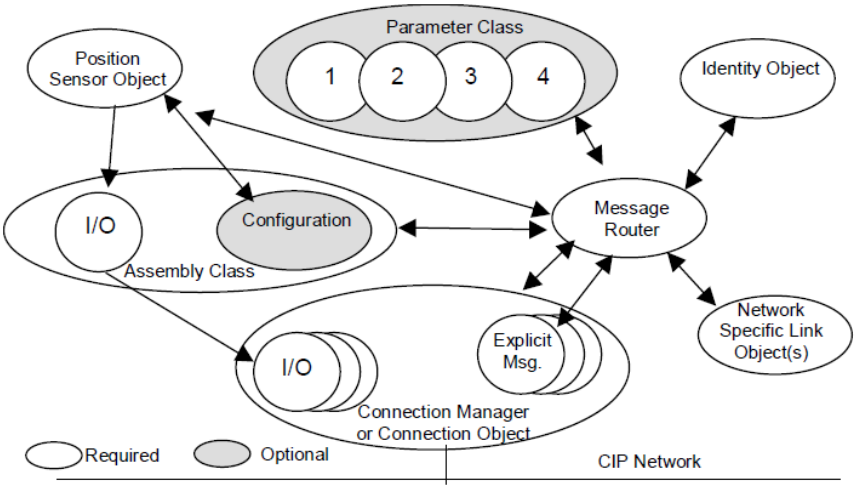


Figure 3: Ethernet/IP Object Model

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.

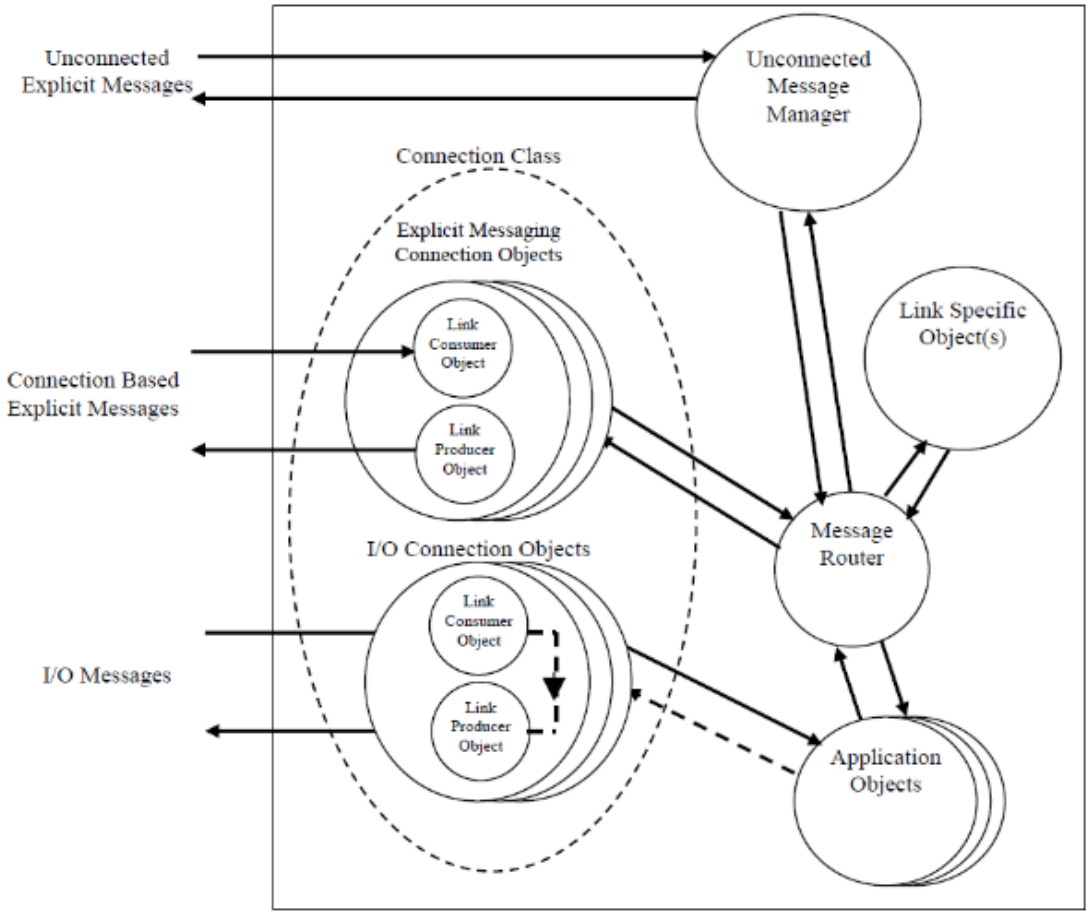


Figure 4: Data Transmission in Ethernet/IP

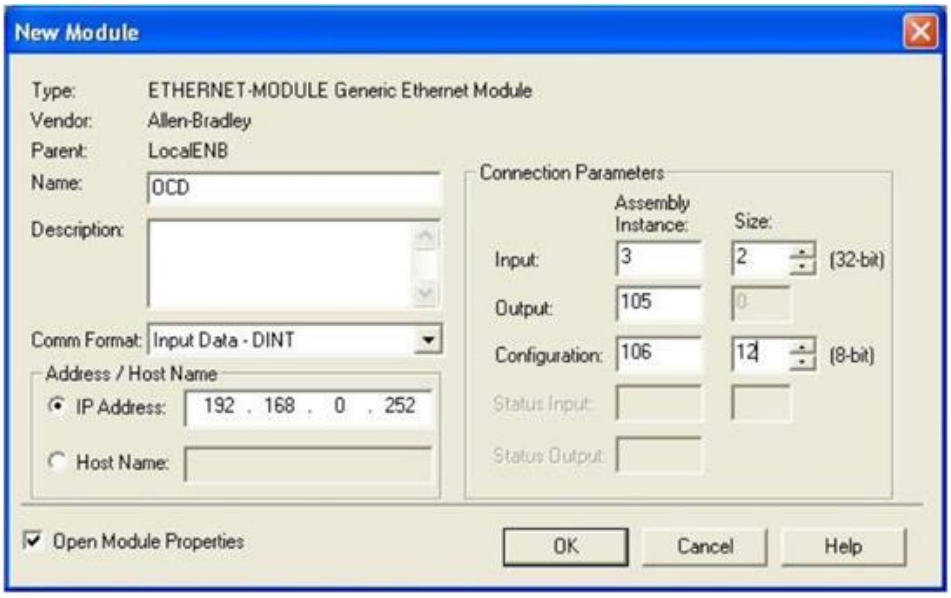
Input Only

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



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.

2.1.1 I/O Assembly Instances

Instance	Type	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	Direction Counting Toggle 8 bits, Scaling Function Control 8 bits, Measuring Units per Revolution 32 bits, Total Measuring Range 32 bits, Velocity Format 16 bits, Velocity Filter 8 bits, Parameter Control Priority 8 bits

Table 2: I/O Assembly Instances

2.1.1.1 Data Attribute Format

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	0	Position Value (low Byte)							
	1								
	2								
	3	Position Value (high Byte)							
2	0	Position Value (low Byte)							
	1								
	2								
	3	Position Value (high Byte)							
	4							Warning	Alarm
3	0	Position Value (low Byte)							
	1								
	2								
	3	Position Value (high Byte)							
	4	Velocity Value (low Byte)							
	5								
	6								
	7	Velocity Value (high Byte)							

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
120	0	Position Value (low Byte)							
	1								
	2								
	3	Position Value (high Byte)							
	4	Velocity Value (low Byte)							
	5								
	6								
	7	Velocity Value (high Byte)							
	8	Acceleration Value (low Byte)							
	9								
	10								
	11	Acceleration Value (high Byte)							
	12							Warning	Alarm
121	0	Position Value (low Byte)							
	1								
	2								
	3	Position Value (high Byte)							
	4	Velocity Value (low Byte)							
	5								
	6								
	7	Velocity Value (high Byte)							
	8	Acceleration Value (low Byte)							
	9								
	10								
	11	Acceleration Value (high Byte)							
	12	Temperature Value (low Byte)							
	13								
	14								
	15	Temperature Value (high Byte)							
	16							Warning	Alarm

Table 3: Data Attribute Format

2.1.2 Data Mapping

Data Component Name	Class		Instance Number	Attribute	
	Name	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	$7C_{hex}$
Temperature Value	Position Sensor	23_{hex}	1	Temperature Value flag	$7D_{hex}$

Table 4: Data Mapping

2.1.3 Data Mapping (Parameter)

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

Configuration Parameter Name	Class		Instance Number	Attribute	
	Name	Number		Name	Number
Direct Counting Toggle	Position Sensor	23_{hex}	1	Direct Counting Toggle	$0C_{hex}$
Scaling Function Control	Position Sensor	23_{hex}	1	Scaling Function Control	$0E_{hex}$
Measuring units per Revolution	Position Sensor	23_{hex}	1	Measuring Units per Span	10_{hex}
Total Measuring Range in measuring units	Position Sensor	23_{hex}	1	Total Measuring Range in measuring units	11_{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 Priority	Position Sensor	23_{hex}	1	Parameter Control Priority	71_{hex}

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
122	0	Direction Counting Toggle							
	1	Scaling Function Control							
	2	Measuring Units per Revolution (low Byte)							
	3								
	4								
	5	Measuring Units per Revolution (high Byte)							
	6	Total Measuring Range in Measuring Units (low Byte)							
	7								
	8								
	9	Total Measuring Range in Measuring Units (high Byte)							
	10	Velocity Format (low Byte)							
	11	Velocity Format (high Byte)							
	12	Velocity Filter							
	13	Parameter Control Priority							

Table 6: Data Offset

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] [24 69] [24 01] [80 07 00 01 00100000 00200000 1F04 01 00]

Segment Groups	Segment	Description
Application Path	20 04	Assembly object class
	24 7A	Instance segment type with Assembly Instance $0x7A_{hex}$ (122) (Configuration)
	24 69	Assembly Instance $0x69_{hex}$ (105) (Output controller to encoder)
	24 01	I/O Assembly Instance 1 (Position value)
	80 07	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

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

2.2.2 Position Sensor Objects

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

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
$7C_{hex}$	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

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: $F5_{hex}$

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
11_{hex}	Set	Last Conflict Detected (ACSI)	STRUCT of:	Not Supported
		Add Activity	USINT	
		Remote MAC	Array of 6 USINT	
		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

2.3.1 Status Instance Attribute (01_{hex})

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

2.3.2 Configuration Instance Attribute (02_{hex})

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 (04_{hex})

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

2.3.4 Physical Link Object (05_{hex})

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-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).

For example, the path could be as follows:

Path	Meaning
0-3	[20] = 8-bit class segment type; [F6] = Ethernet Link Object class. [24] = 8-bit instance segment type; [01] = instance 1.

Table 14: TCP/IP Interface Objects – Attribute 05hex

2.3.5 Interface Configuration (06_{hex})

Name	Meaning
IP Address	The IP address of the device. Value of 0 indicates that no IP address has been configured. 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/IP Interface Objects – Attribute 06hex

2.3.6 Host Name

Name	Meaning
Host Name	ASCII characters. Maximum length is 64 characters. Shall be padded to an even number 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

2.4 Ethernet Link Object

Class Code: $F6_{hex}$

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

2.4.0 Instance Attributes

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

Table 18: Ethernet Link Objects – Instance Attributes

ID	Access	Name	Data Type	Description of Attribute	Semantics of Values
5	Get	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	
		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	Set	Interface Control	STRUCT of:	Configuration for physical interface	
		Control Bits	WORD	Interface Control Bits	See table below
		Forced Interface Speed	UINT	Speed at which the interface shall be forced to operate	Speed in Mbps (10 or 100)

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_STRING	Human readable identification	„Internal switch“ or „External Port 1“ or „External Port 2“
11	Get	Interface Capability	STRUCT of:	Indication of capabilities of the interface	
		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
			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 part of attributes 4, 5 and 13	
15	Get	Link Down Counter	UDINT	Counts the number of times a Link Down transition event was detected on this port	

Control Bits

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

2.4.1 Interface 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
$0E_{hex}$	Conditional	Required	Get_Attribute_Single	Returns the contents of the specified attribute
10_{hex}	n/a	Conditional	Set_Attribute_Single	Modifies a single attribute

Table 21: Ethernet Link Objects – Common Services

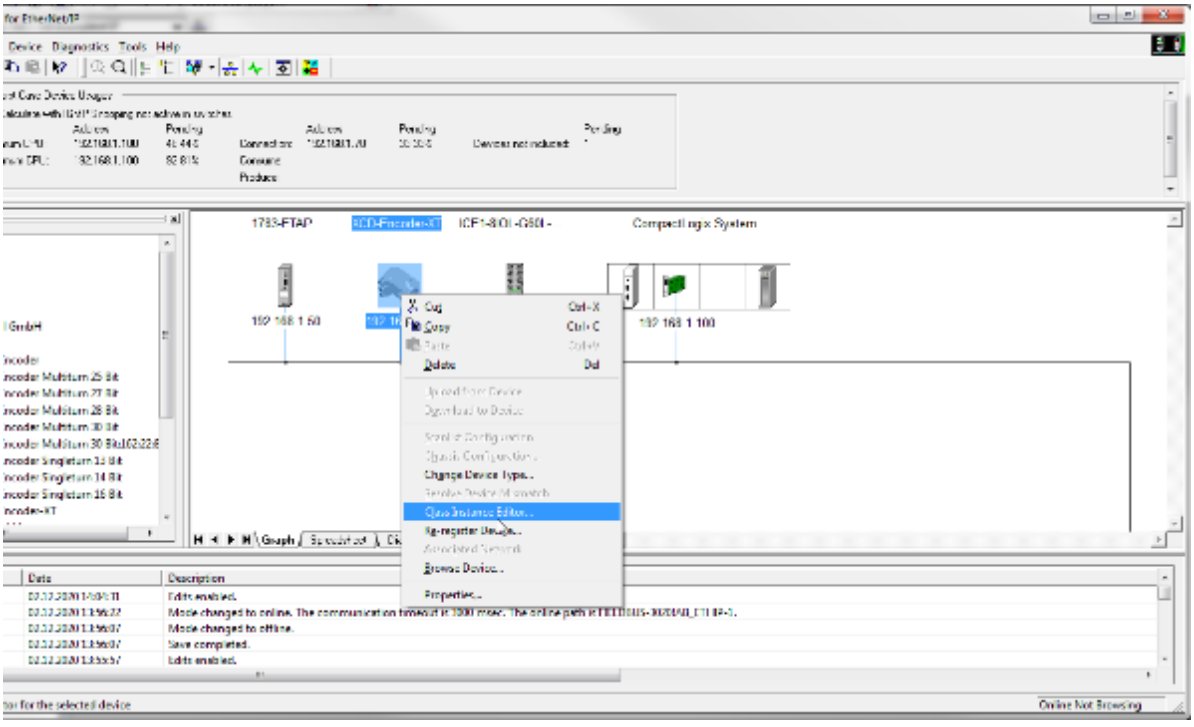
2.4.3 Link Object Instances

Instance	Description
1	Internal interface
2	Intern switch Port 1
3	Intern switch Port 2

Table 22: Link Object Instances

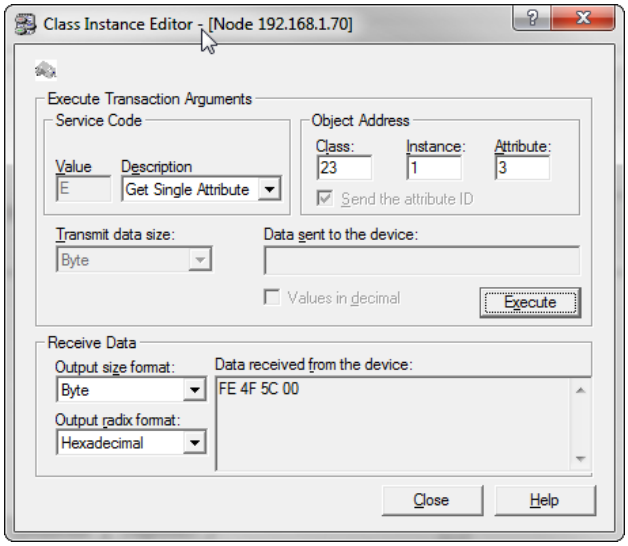
2.5 Setting parameters with scanners

Several external scanners exist for EtherNet/IP available. RS-NetWorx™ 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.



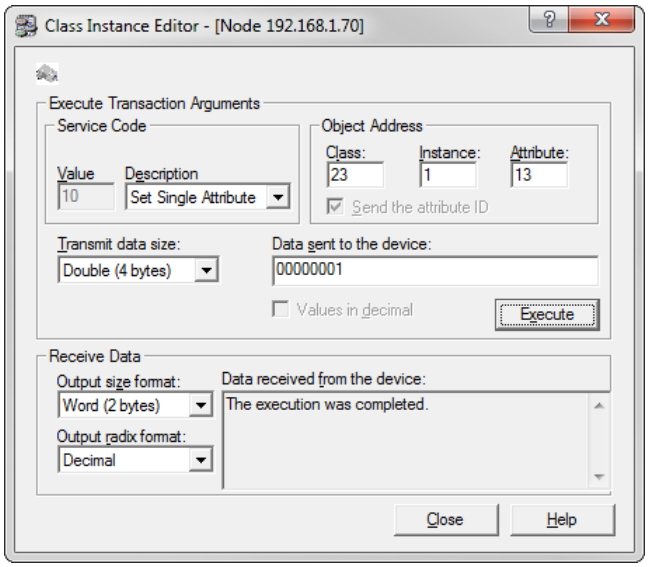
2.5.1 Read out position value

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



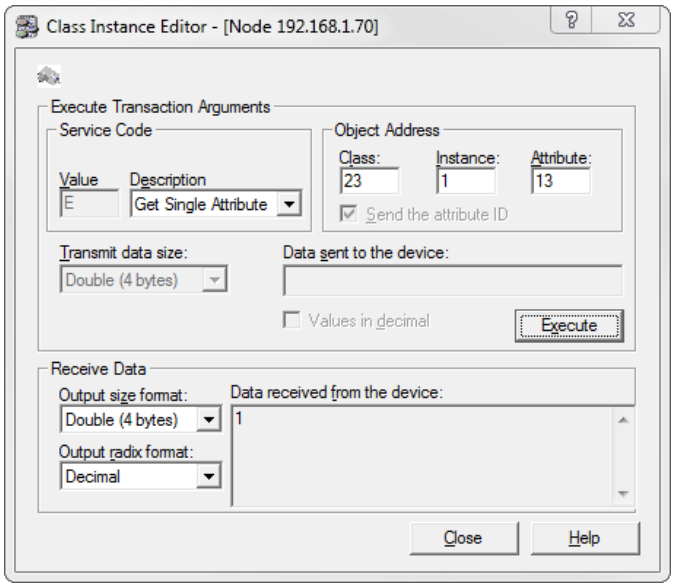
2.5.2 Set preset value

Set Single Attribute Position Preset Value to 1
Class: 0x23 (Position sensor object)
Instance: 0x01
Attribute: 0x13 (Preset Value)



2.5.3 Get preset value

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



3 Diagnostics

LED	Color	EtherNet/IP name	Description
Active1	Yellow	Network Status Indicator 1	Details in Table 24
Link1	Green		
Active2	Yellow	Network Status Indicator 2	Details in Table 24
Link2	Green		
Stat1	Green	Module Status Indicator	Details in Table 23
Stat2	Red		

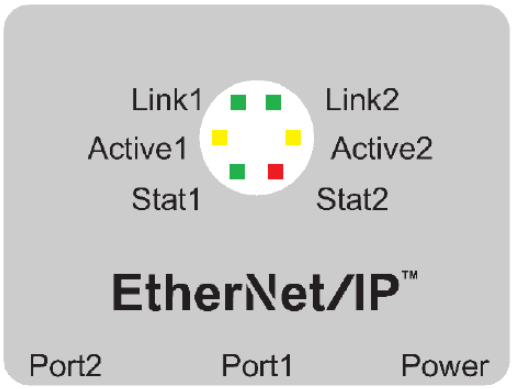


Figure 6: Diagnostic LEDs

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

Table 23: Module Status Indicator Stat1/Stat2

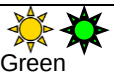
LED	Summary	Requirements
Steady Off 	No power, no IP address	If the device does not have an IP address or is powered off
Steady Green 	Connected	If the device has at least one established connection (even to the Message router)
Flashing Green 	No connection	If the device has no established connections,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

Table 24: Network Status Indicator Stat2

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
$0C_{hex}$	0_{hex}	0_{hex} - 1_{hex}	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 $0C_{hex}$:

Bit 0	Counting direction	Position values
0	CW	Increase
1	CCW	Decrease

Table 26: Direction Counting Bits

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
$0E_{hex}$	0_{hex}	0_{hex} - 1_{hex}	Boolean

Table 27: Scaling Function Control

This parameter can be set via Configuration Assembly and Explicit Messaging

Bit 0	Scaling function on/off
0	OFF
1	ON

Table 28: Scaling Function Control Bits

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 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}	(*)	0_{hex} - 10000_{hex}	Double Integer 32

Table 29: Resolution per Revolution

(*) see type label, maximum resolution:
16Bit Encoder: $10{,}000_{hex}$ (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.

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 Resolution

(*) see type label
Maximum total resolution
30 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}	0_{hex}	0_{hex} - total measuring range	Unsigned Integer 32

Table 31: Preset Value

4.6 Velocity Format

The default value for Velocity Format is steps per second. This parameter can be set via Configuration Assembly or Explicit Messaging.

Attribute ID	Default value	Value range	Data length
19_{hex}	$1F04_{hex}$	0800_{hex}	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 EtherNet/IP encoders can solve the problem directly. It will check whether *n* is an integer (see equation here above).
If not, it will run calculous to make sure we do not see any drops in the position (see pictures here after).
The Endless Shaft functionality must however be enabled.
Default value: Auto.
Can be set only via Explicit Messaging.

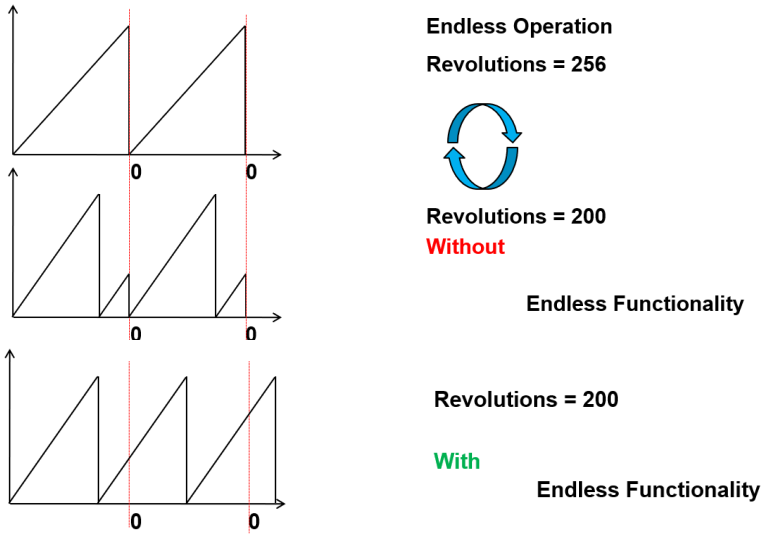


Figure 7: Endless Shaft

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}	0_{hex} / 1_{hex} / 2_{hex}	0 = Off, 1 = On, 2 = Auto	Double Integer

Table 34: Endless 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}	0_{hex}	0_{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 ($2C_{hex}$) and 47 ($2F_{hex}$) 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)

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

Table 36: Alarms

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

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 re-routed backwards to the other devices on the ring, should a failure occur.

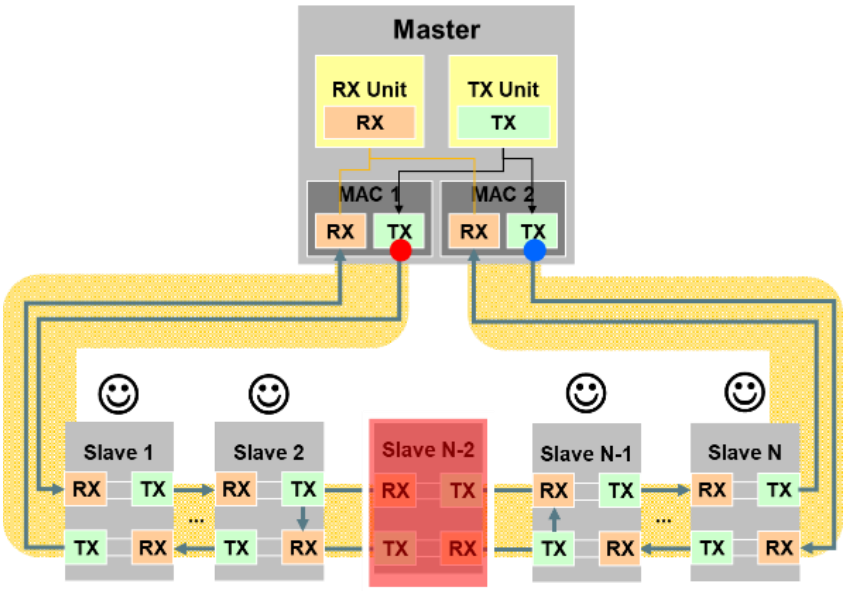


Figure 8: Device level Ring

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

Connector Ethernet
4 pin female, D-coded

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

Table 38: Data Pin Assignment

Connector power supply
4 pin male, A-coded

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

Table 39: Power Supply Pin Assignment

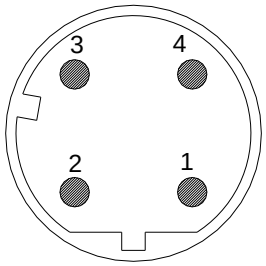


Figure 9: Ethernet Connector

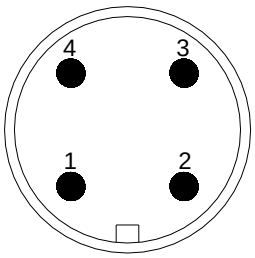


Figure 10: Power Supply Connector

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

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

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

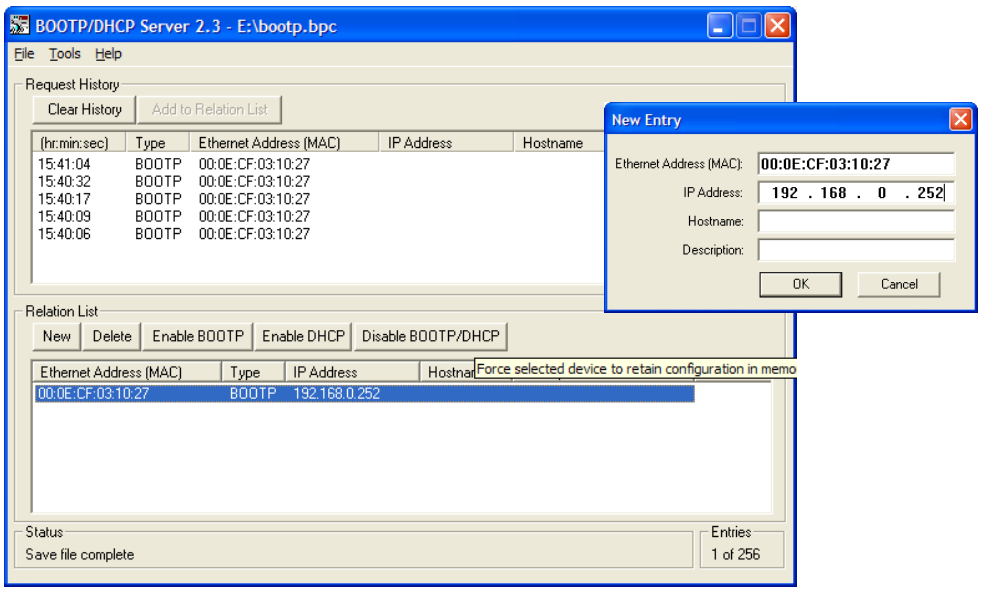
If you cannot find all the encoders within the BOOTP Server list then check the following points:

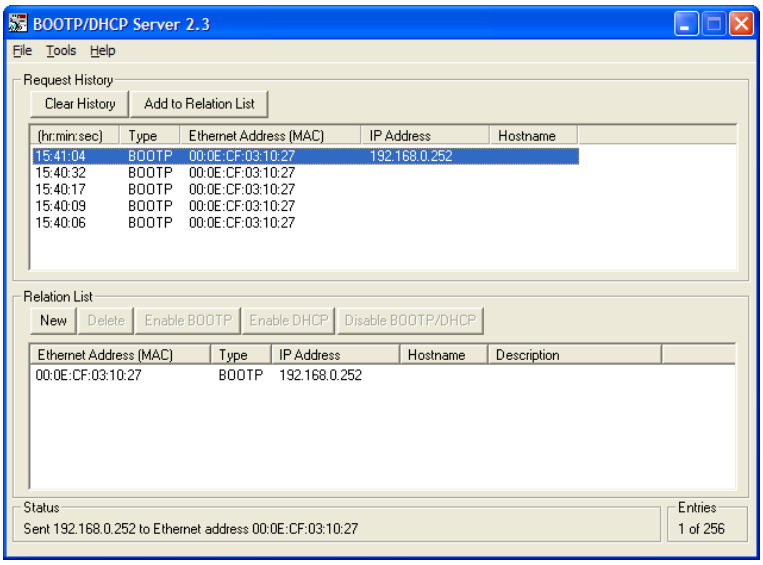
- LED status of the encoder OK?
- Is the Network correctly set?
- Is the BOOTP enabled?

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 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





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.

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, 889-999	- On activated BOOTP the encoder gets its IP address and the other 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

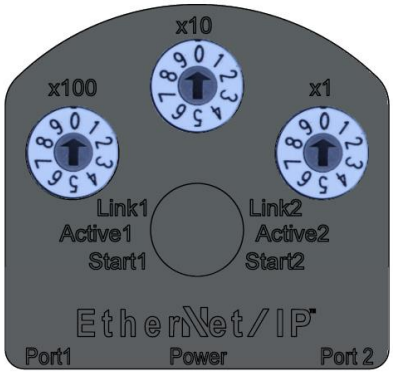
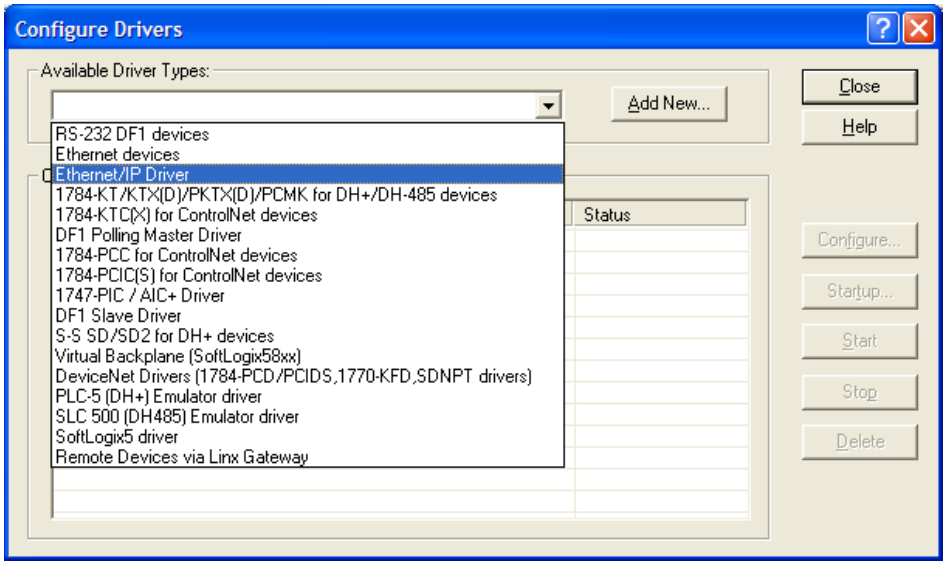


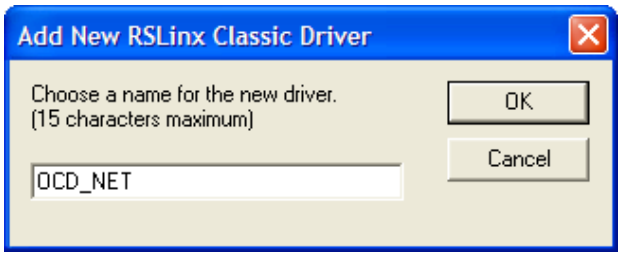
Figure 11: IP Address Rotary Switches

7.1.2 Configuration RSLinx Classic™

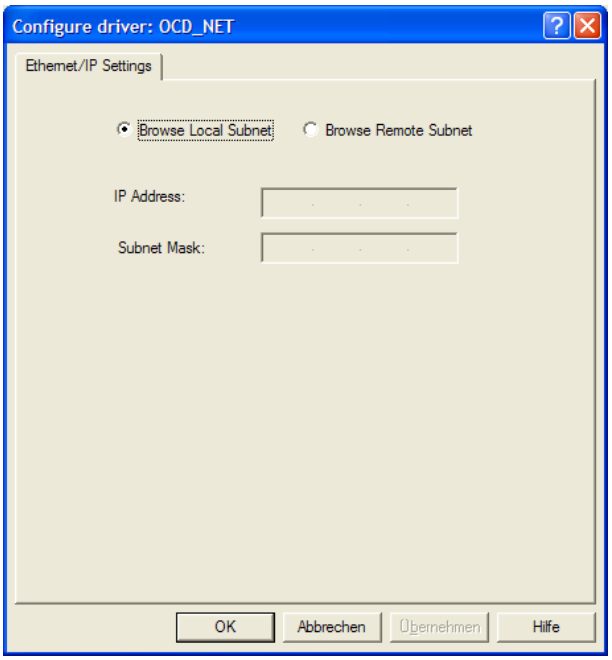
RSLinx™ is a complete communication server providing plant-floor device connectivity for a wide variety of Rockwell Software applications such as RSLogix™, RSNetWorx™,…

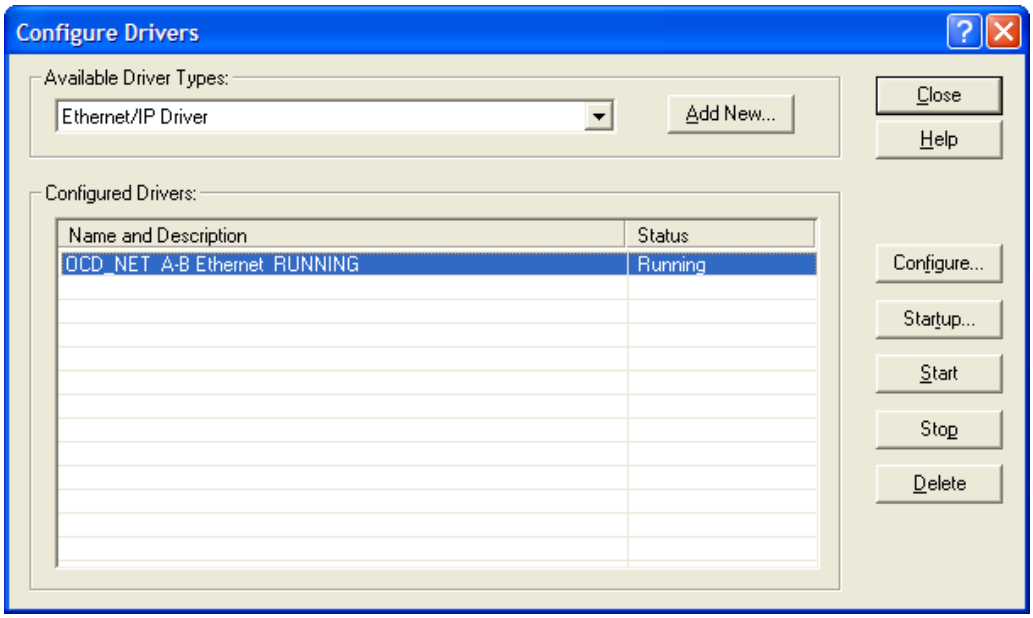
To start a new project add first a new RSLinx Classic™ Driver for EtherNet/IP under *Communications Configuration Drivers* and input the name.





Use *Browse Local Subnet* to find the EtherNet/IP components in the network. The status should be "Running". Then push the *Close* button to finish this configuration.



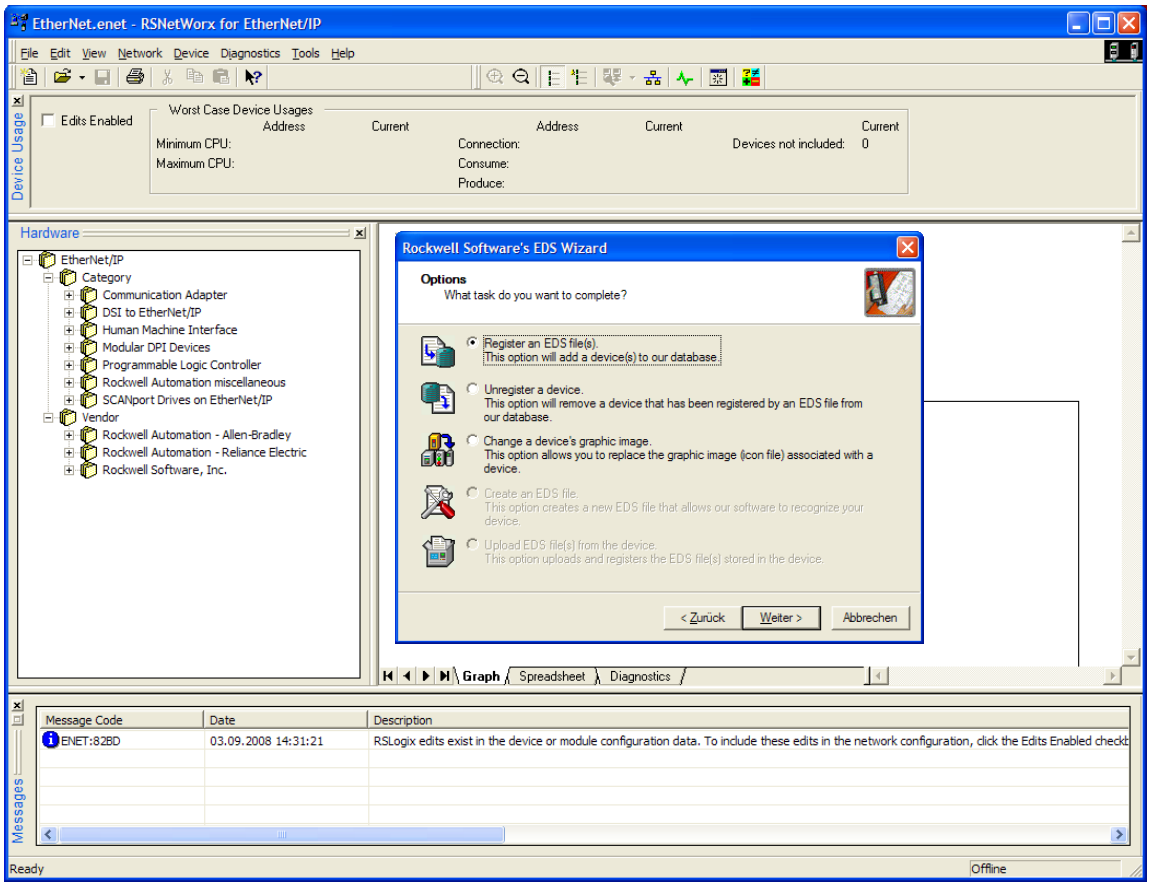


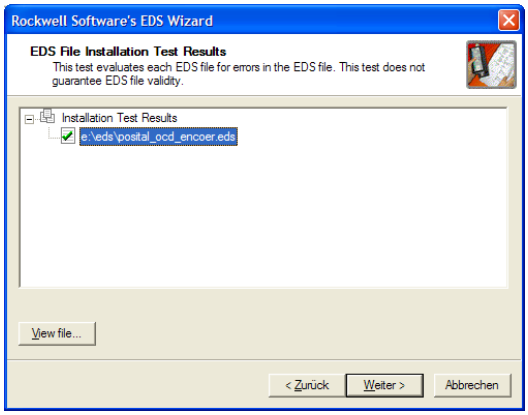
7.1.3 RSNetWorx™

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

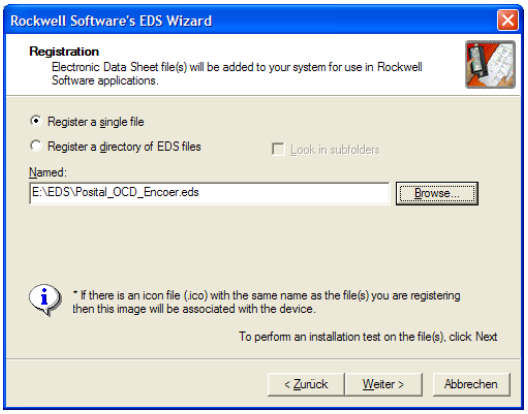
EDS Wizard

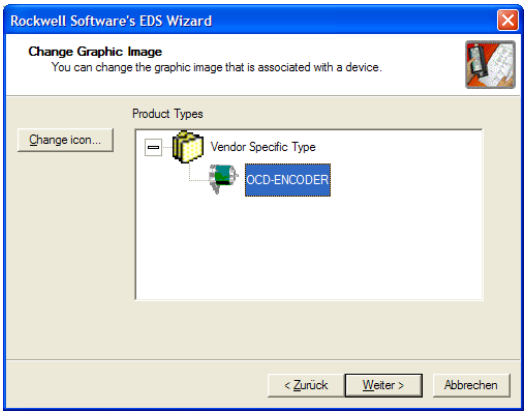
The EDS File contains information about device specific parameters as well as possible operating modes of the encoder. With this file you have a data sheet in an electronic format, which can be used to configure the device in the network, for example with RSNetWorx™ from Rockwell. In this sample the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

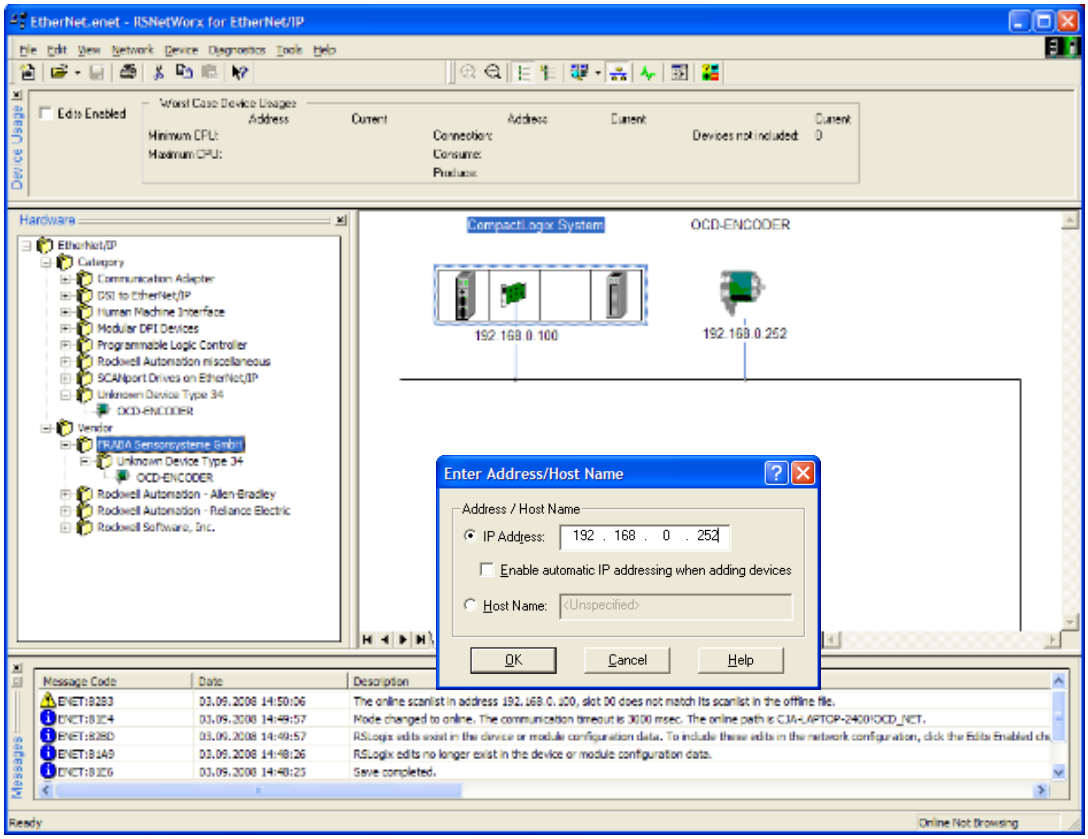




The Wizard finds all EDS files that are discarded in the choosing path and operates a test to check the EDS files on errors. In the next step pictures can be selected for the using nodes. With the button *waiter* the installation can be continued and finished.

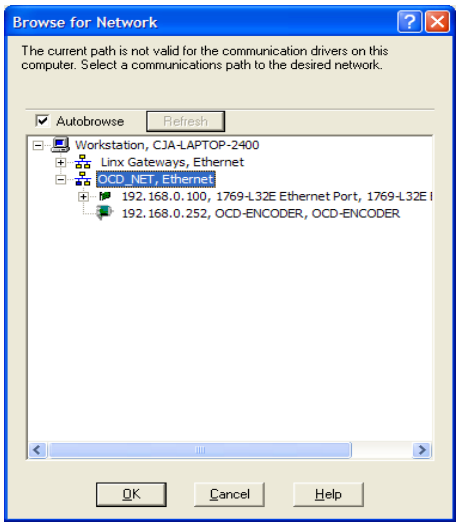






Load a saved *.enet file or start a new project.
Add the devices per Drag and Drop to the network
Line and set the IP-Address

Optionally, browse the network with all devices with Button  or *Upload from Network*. It is not necessary to set the IP-Address manually. To use this configuration in RSLogix save the *.enet file.

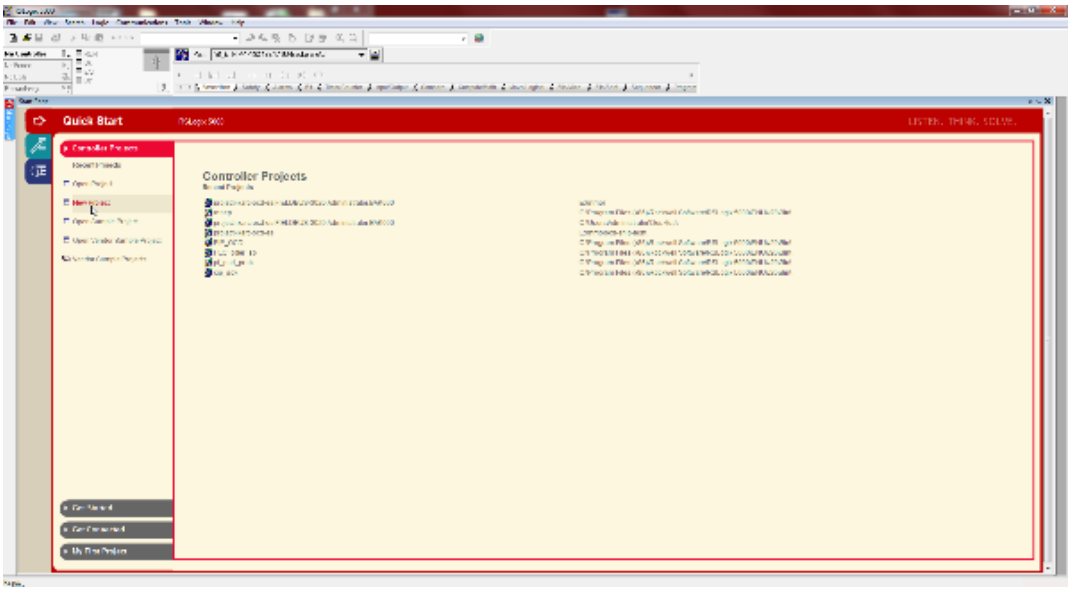


7.1.4. Configuration RSLogix 5000

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



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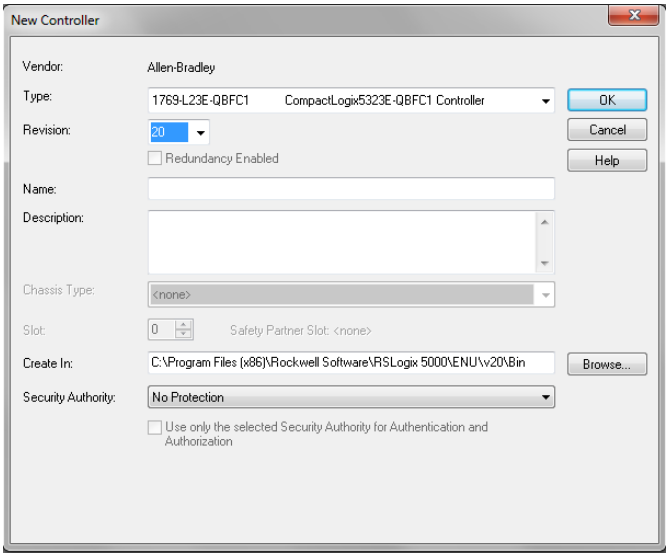
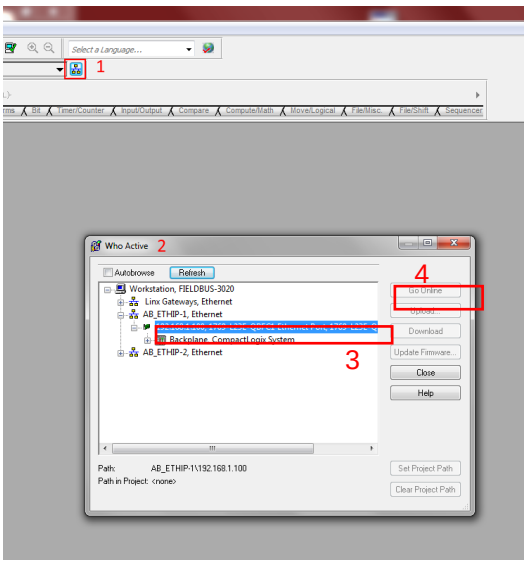
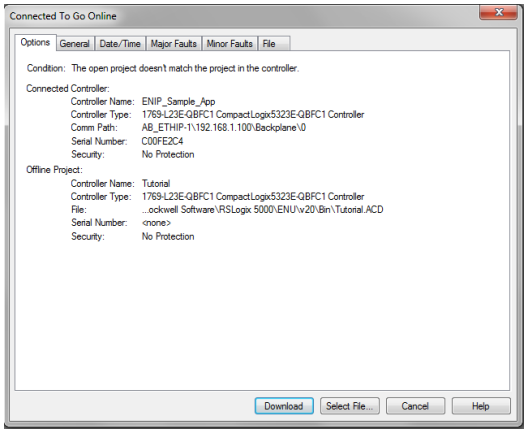
2. Choose your PLC in the available list



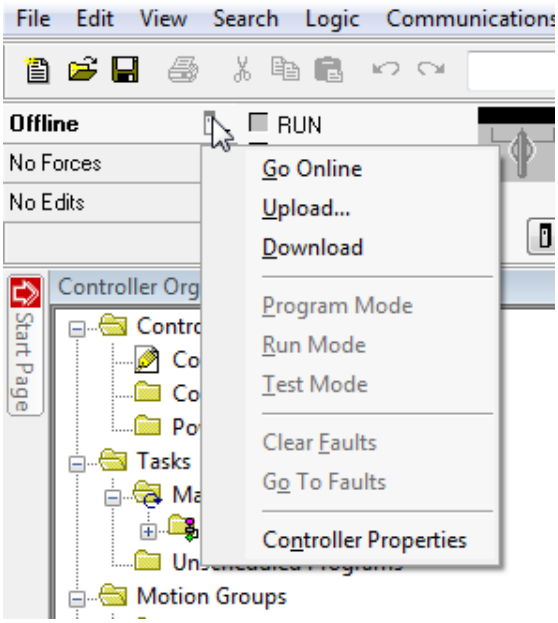
3. Look for the connection path to the encoder (1) In the pop-up window (2) Select the encoder (3) and Click on **Go Online (4)**.



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



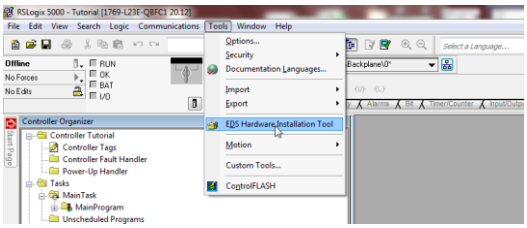
5. Go **Offline** (necessary to perform changes in the configuration)



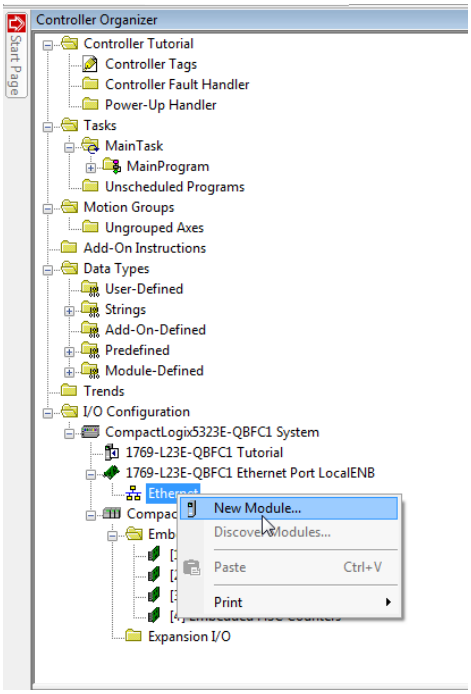
6. Add the EDS file

   Click on **EDS Hardware Installation Tool**

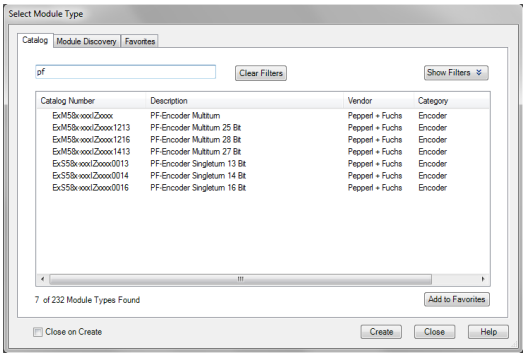
   Next -> **Register an EDS** -> **Next** -> **Browse** to the EDS file location -> **Next** -> **OK**



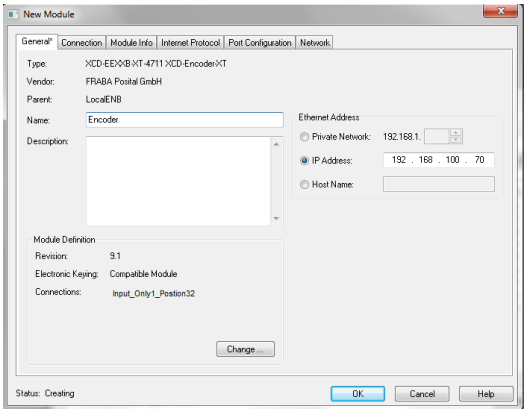
7. Add a new module



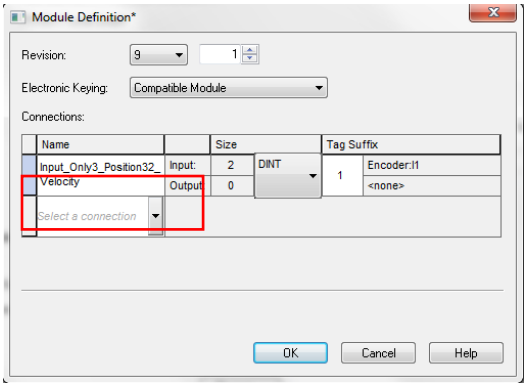
8. Look for your encoder



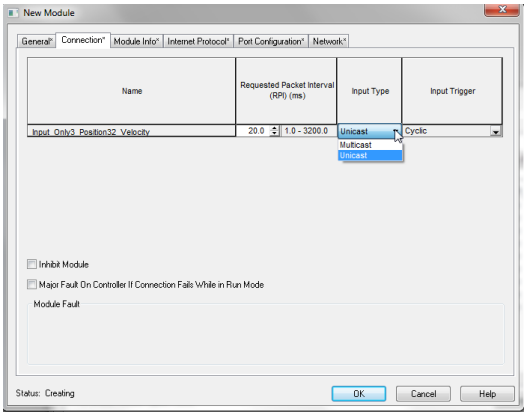
9. Set Name and IP address



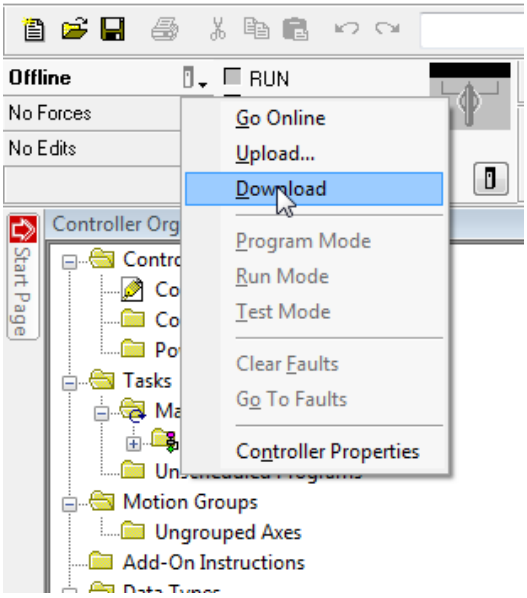
10. Select the relevant input assembly
Do not forget to select the right size and format(1)



11. Configure Cycle Time, Multicast/Unicast, Input Trigger

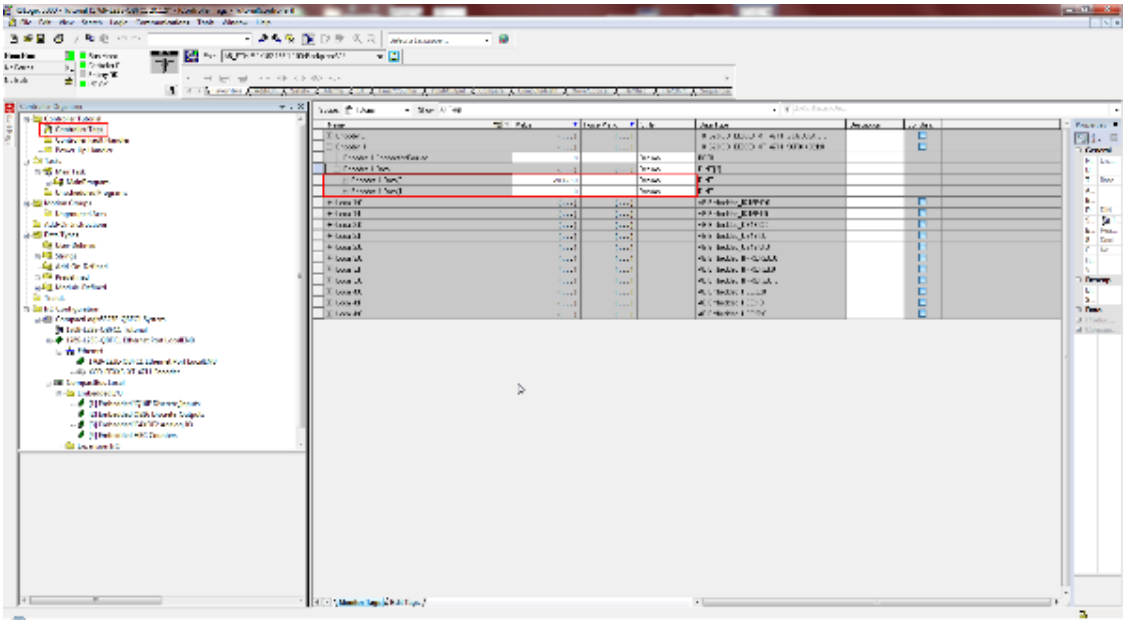


12. Download the configuration on the PLC

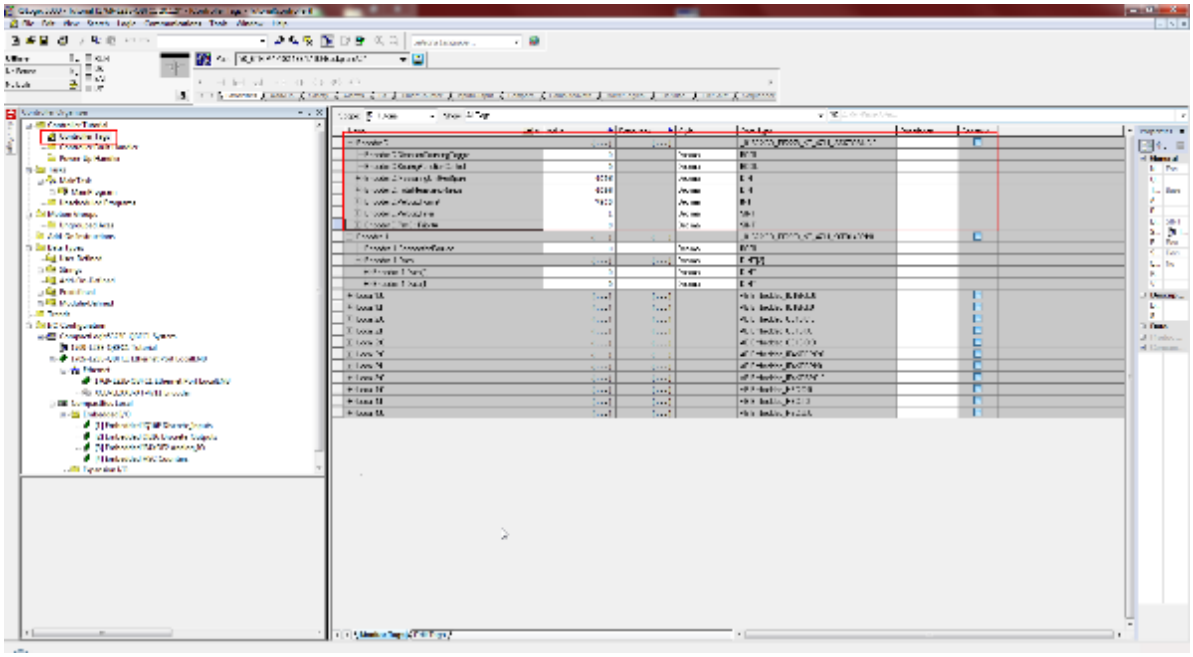


(1) You can change the Input Assembly later by Going **Offline** -> Changing the **Input Assembly** (in the same window) -> **Download** on the PLC

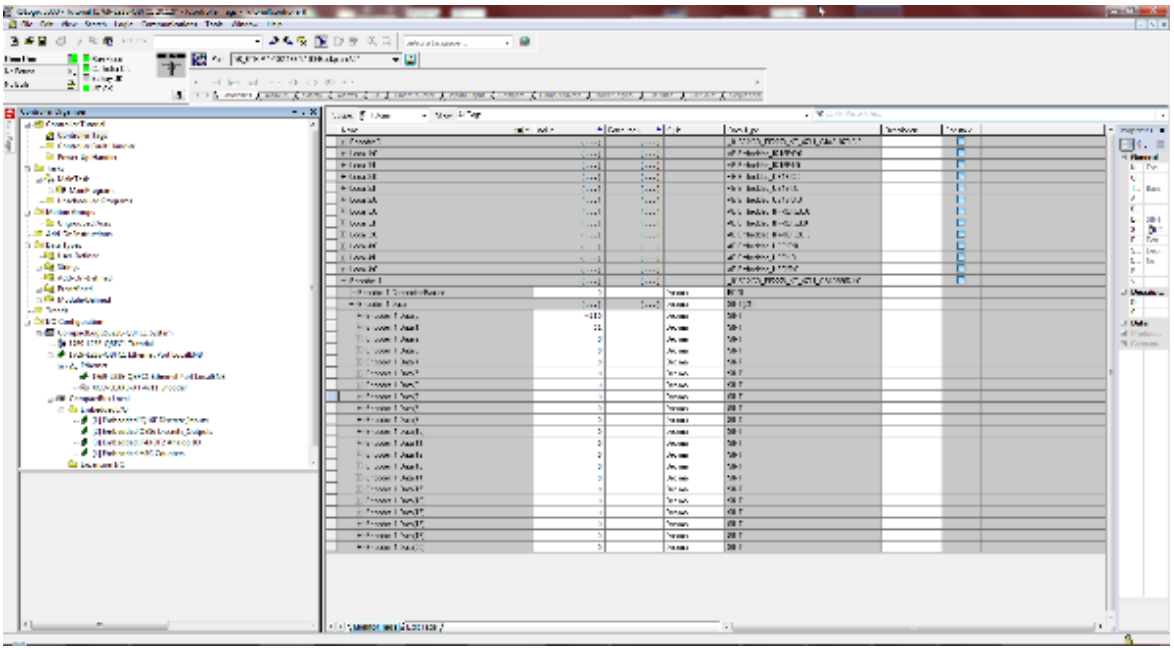
13. In the **Controller Tags** window, you can see *Position* and *Velocity*



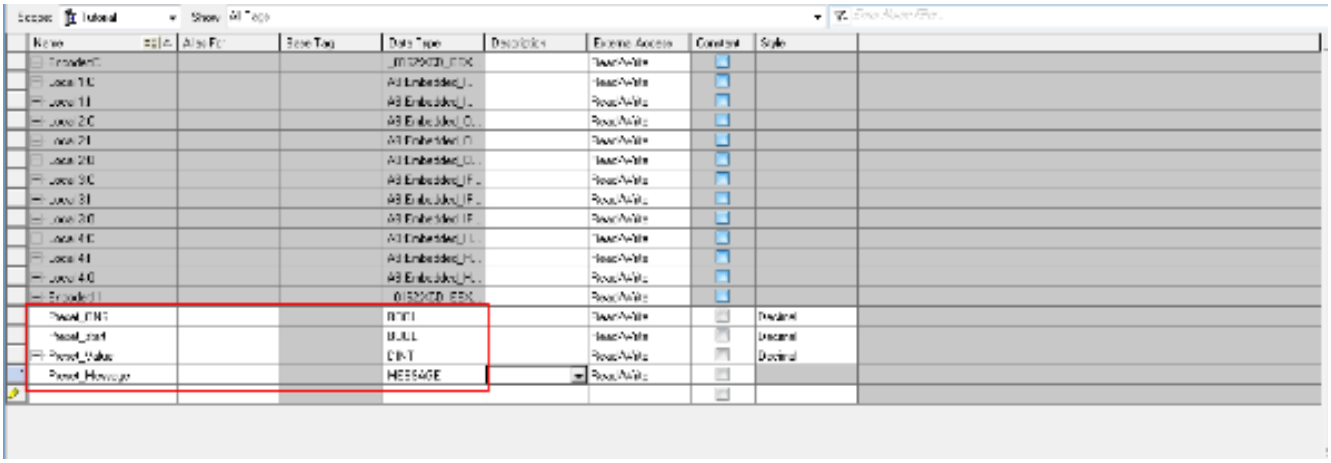
14. In the **Controller Tags** Window, you can set the following parameters:
    DirectionCountingToogle, ScalingFunctionControl, MeasuringUnitPerSpan,TotalMeasuringRange,VelocityFormat, VelocityFilter,PrmCtrlPriority



15. You can see Acceleration, Temperature and Warning Flags by selecting the Input Assembly 121 as instance (see pa
10 and note (1))
The values of the different Bytes are then visible in the **Controller Tags** window

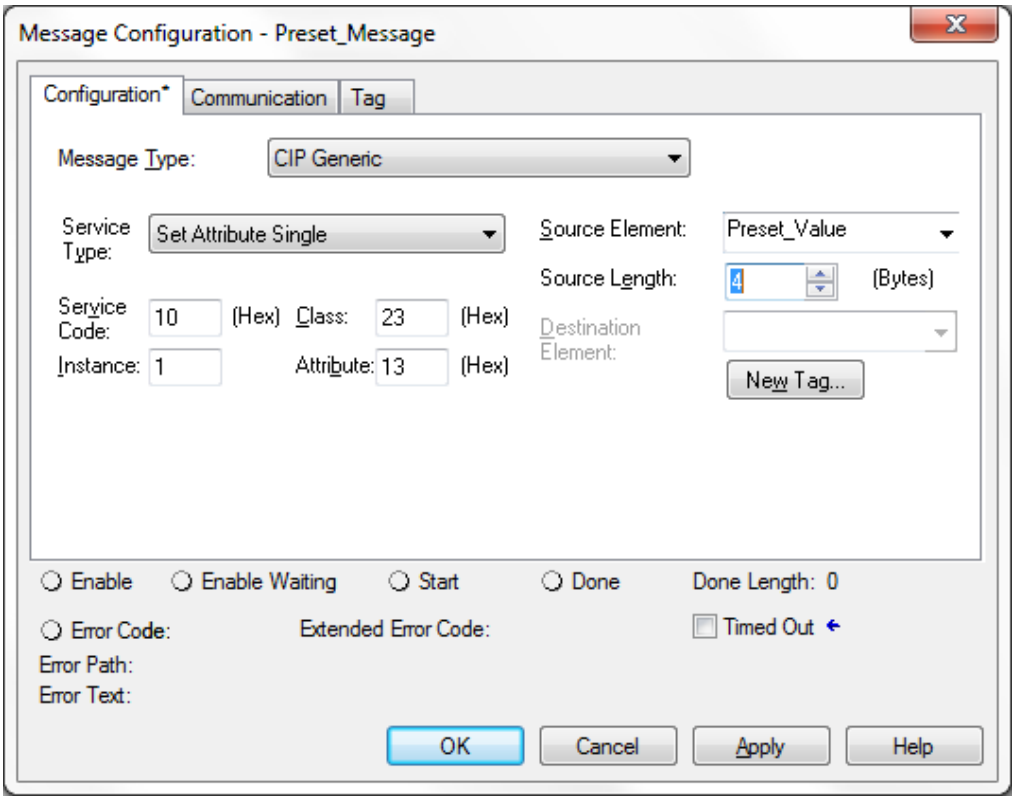


16. Set Preset
In the **Controller Tags** wndow, Create the following tags:

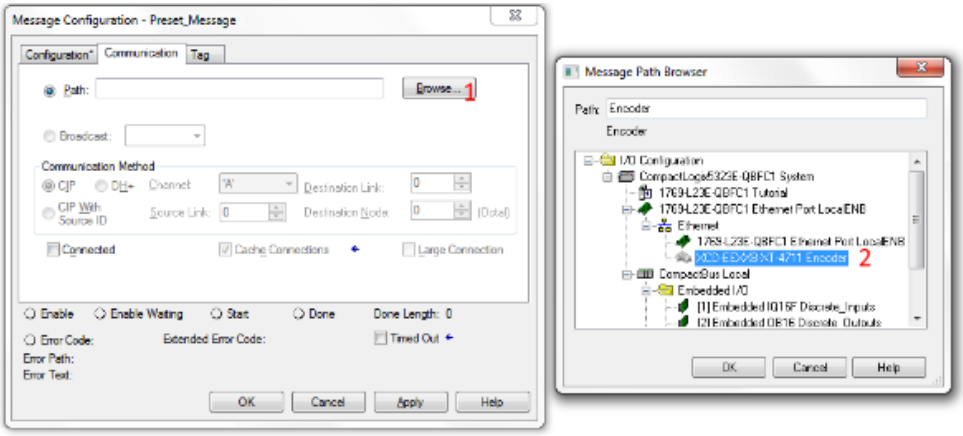


Create the following Main Routine
Click on **View Configuration**

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

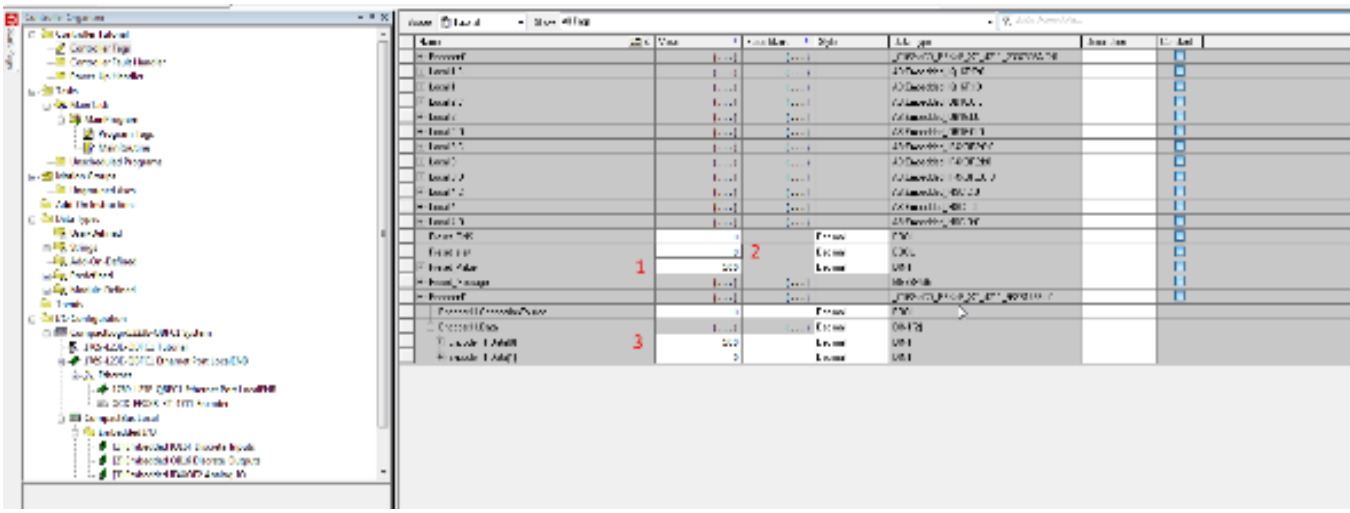


In the **Communication** tab, **Browse** (1) for the encoder (2)
Click on **Apply** and **OK**
Download the configuration



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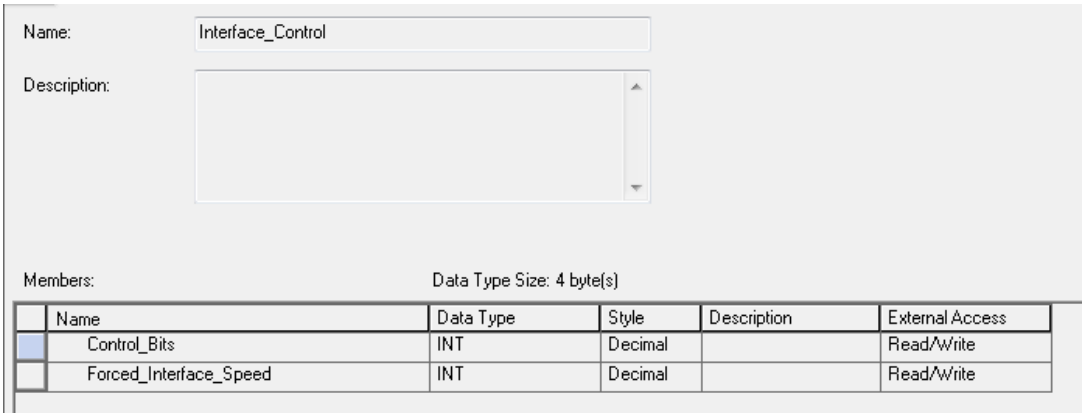
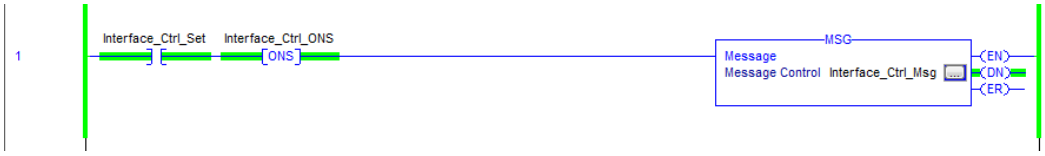
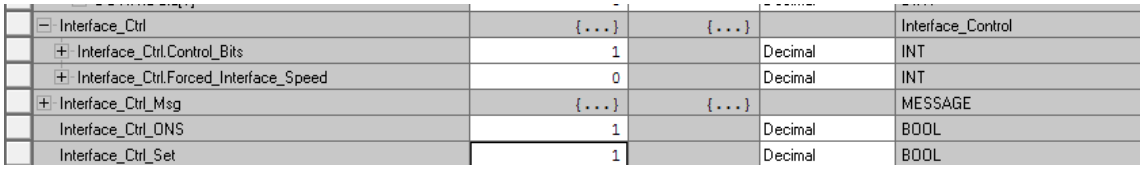
17. Set Auto-negotiate and Half/Full Duplex Mode
    Define **User Type** as follows:



Create the following **Ladder Program**:

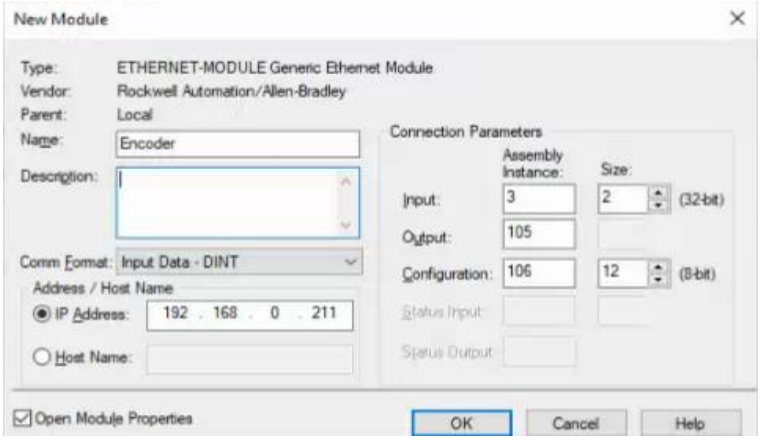


You can now change the parameters in the Controller Tags window



7.1.4.1. Generic Module Configuration

1. Add the Generic Module in the project



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	Value	Force Mask	Style	Data Type	Description
◢ Encoder:C	{...}	{...}		AB:ETHERN...	
◢ Encoder:C.Data	{...}	{...}	Hex	SINT[400]	
▸ Encoder:C.Data[0]	16#00		Hex	SINT	Direction Counting Toggle
▸ Encoder:C.Data[1]	16#01		Hex	SINT	Scaling Function Control
▸ Encoder:C.Data[2]	16#e8		Hex	SINT	Measuring Units per Span byte 0 (LSB)
▸ Encoder:C.Data[3]	16#03		Hex	SINT	Measuring Units oer Span byte 1
▸ Encoder:C.Data[4]	16#00		Hex	SINT	Measuring Units per Span byte 2
▸ Encoder:C.Data[5]	16#00		Hex	SINT	Measuring Units per Span byte 3 (MSB)
▸ Encoder:C.Data[6]	16#1d		Hex	SINT	Total Measuring byte 0 (LSB)
▸ Encoder:C.Data[7]	16#09		Hex	SINT	Total Measuring byte 1
▸ Encoder:C.Data[8]	16#00		Hex	SINT	Total Measuing byte 2
▸ Encoder:C.Data[9]	16#00		Hex	SINT	Total Measuring byte 3 (MSB)
▸ Encoder:C.Data[10]	16#0f		Hex	SINT	Velocity 0 (LSB)
▸ Encoder:C.Data[11]	16#1f		Hex	SINT	Velocity 1 (MSB)

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

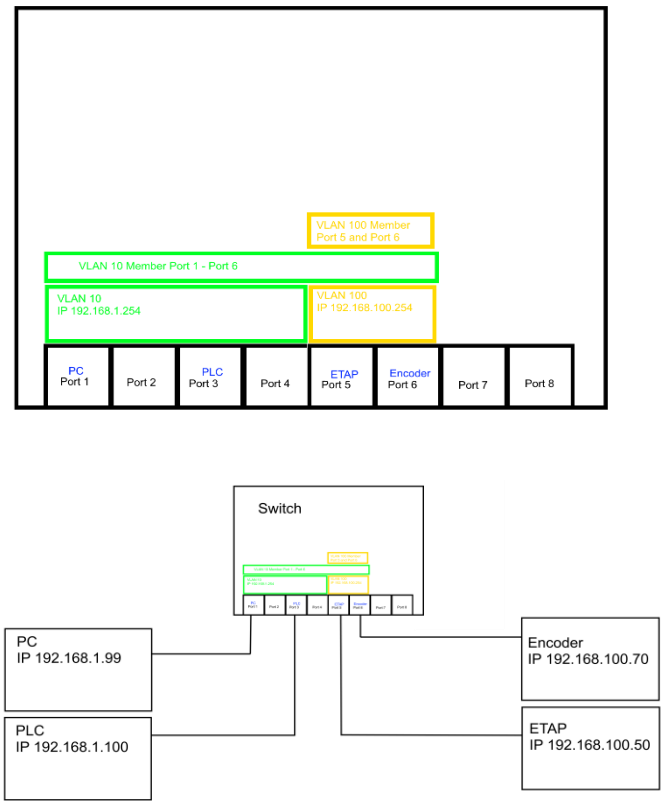


Figure 12: Example of VLAN Setup

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.

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.

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	**C**ontrol and **I**nformation **P**rotocol
DHCP	**D**ynamic **H**ost **C**onfiguration 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	**D**evice **L**evel **R**ing
EIP	**E**theNet**/IP**
EMC	**E**lectro**m**agnetic **c**ompatibility, 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 **I**nternet **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 **I**nterconnection 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.

TCP	The **T**ransmission **C**ontrol **P**rotocol is a connection orientated transmission protocol, in a network.
UDP	**U**ser **D**atagram **P**rotocol is utilized to send data that does not need to be transferred in a reliable way.

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