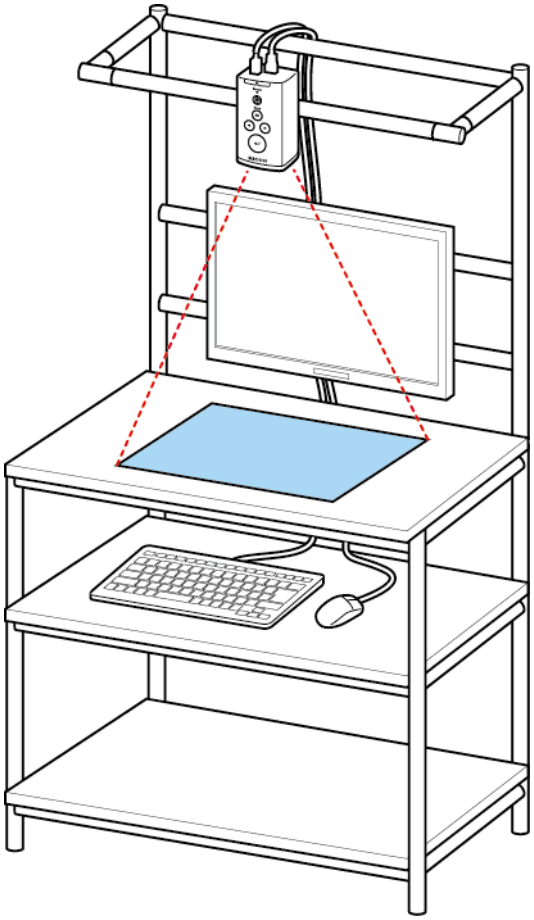
RICOH

INSPECTION CAMERA SYSTEM

RICOH SC-10 SERIES

EtherNet/IP Operating Instructions



RICOH Industrial Solutions Inc.

How to Read This Manual

About Symbols

The symbols used in this manual have the following meanings.

Important

Indicates an explanation containing points to pay attention to when operating the device, restrictions, or other information. Be sure to read the explanation.

Note

Indicates an explanation containing information that is useful to know, a supplementary operating procedure, or other information.

Reference / (→P. ##)

Indicates reference information.

[ ]

Indicates a screen item or button name.

Contents

1. Overview

The inspection camera system (SC-10A series) can be connected with an external device using the EtherNet/IP.
This manual describes the connection procedure for EtherNet/IP and the data format to set for EtherNet/IP.

EtherNet/IP certification
This device has been certified and registered as an Open Device Vendor Association (ODVA).
Therefore, all of the following specification requirements are met.
• Obtained certification in accordance with ODVA suitability test
• EtherNet/IP Performance Test
• EtherNet/IP PlugFest compatibility
• This device can be operated in combination with other certified manufacturers' devices (interoperability).

TRADEMARK

- Ethernet/IP is ODVA, Inc. Trademarks or registered trademarks of.
- Ethemet is a registered trademark of Xerox Corporation
- IEEE is a trademark of the Institute of Electronic and Electronic Engineers, Inc.
- Designations used by manufacturers and sellers to distinguish their products are claimed as trademarks or registered trademarks.

Applicable Devices

Applicable models
The following devices support Ethernet/IP.
- Inspection camera system: SC-10A (Ver. 5.0.0 or later)
- Inspection camera system: SC-10A (H) (Ver. 5.0.0 or later)

2. EtherNet/IP

Compliant with EtherNet/IP Standard IEEE 802.3

Specification	Compliant with Ethernet II, I IEEE 802.3
Protocol	CIP Network Library Volume 1: Common Protocol for Industry
	CIP Network Library Volume 2: CIP-compatible EtherNet/IP
Communication type	10Base-T
	100Base-TX
Device Profile	General-purpose equipment
Manufacturer ID	1591
Device type ID	0x2B
Communication speed	Auto-1 º/₁ √Mbit (half-duplex and full-duplex)
Polarity	Automatic Polarity (for automatic correction of crossed TxD and RxD pairs)
Number of cyclic and Explicit connections	Maximum 128 × Connected (total)
Equipment setup options	Input from the camera UI
	Electronic data sheets (EDS) embedded in equipment
Configuring the EtherNet interface	Speed: 10 Mbit, 100 Mbit, Automatic (factory setting)
	Double: half duplex, full duplex, automatic (factory setting)
Setting the Device Address	Input from the camera UI
	DHCP
Device Level Ring (DLR)	Not supported
QoS	Response
ACD	Not supported
Port number	CIP: 44818, 2222

Fix mode

RPI	50 Milliseconds to 3200 seconds (factory setting: 50 milliseconds)		
Connection type	Send and receive		
	Sending Only		
	Reception only		
	Reception only (Listen Only)		
Communication setting (common)		Instance	Size [bytes]
	Instance settings:	0x66	4
	O → T setting:	0x64	40
	T → O setting:	0x65	8
Input assembly	Status		
	Matching results		
	Output pin		

Configurable input

RPI	5 Milliseconds to 10 seconds (factory setting: 20 milliseconds)
Input assembly	Matching results
	Camera status

Fixed output

Output assembly	Start of matching
	Matching stop
	External input
	Shut down
	Job ID change
	Sensor brightness adjustment
	Sound settings

Setting

Standard objects predefined	Identity Object (0x01)
	Message Route Object (0x02)
	Assembly Object (0x04)
	Camera Object (0x7F)

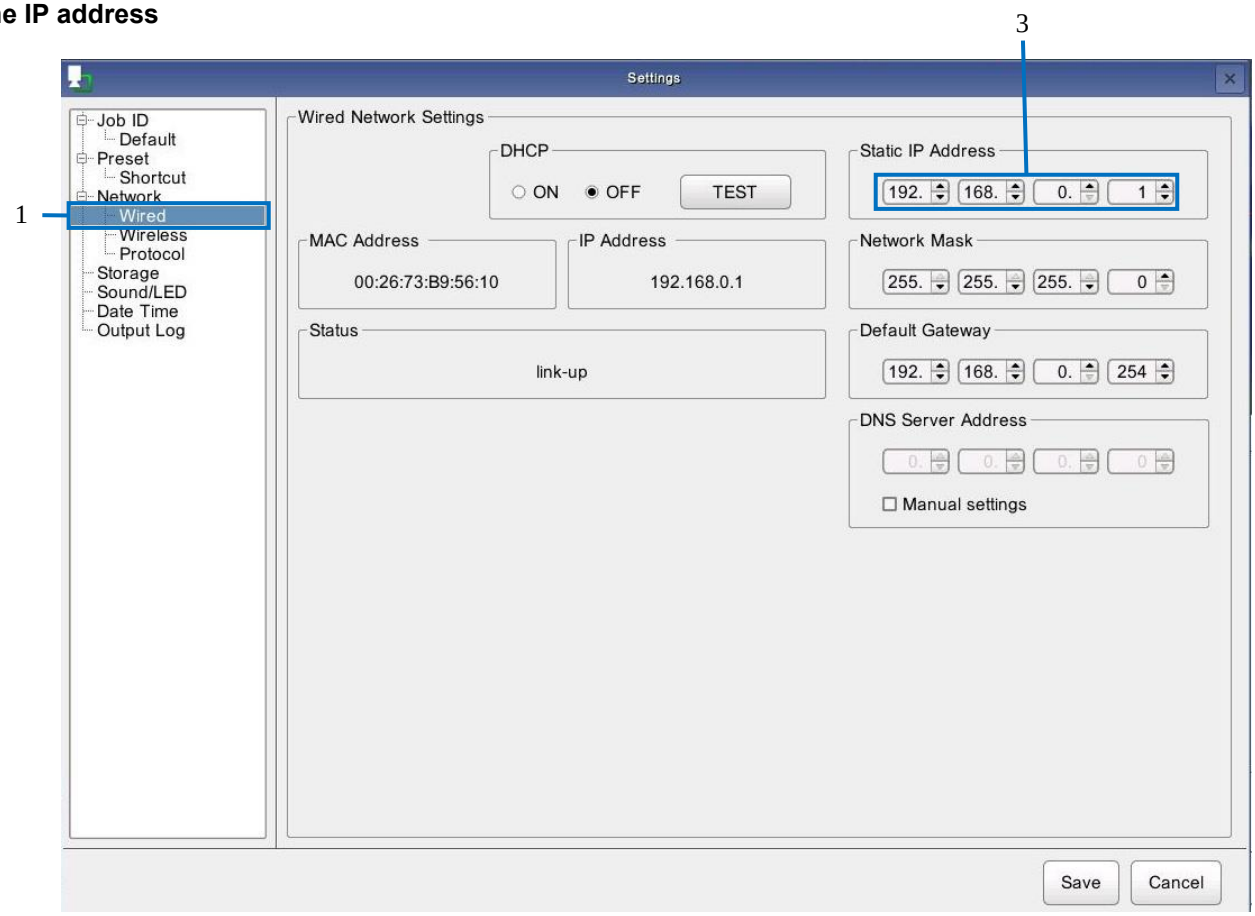
Enabling the EtherNet/IP Mode Control Function

Set the EtherNet/IP mode control function of the SC-10A in the [Settings] screen of the SC-10A.
Log in the SC-10A in the administrator mode and then select [Job Settings...] in the [Job] menu to display the [Settings] screen.

Reference

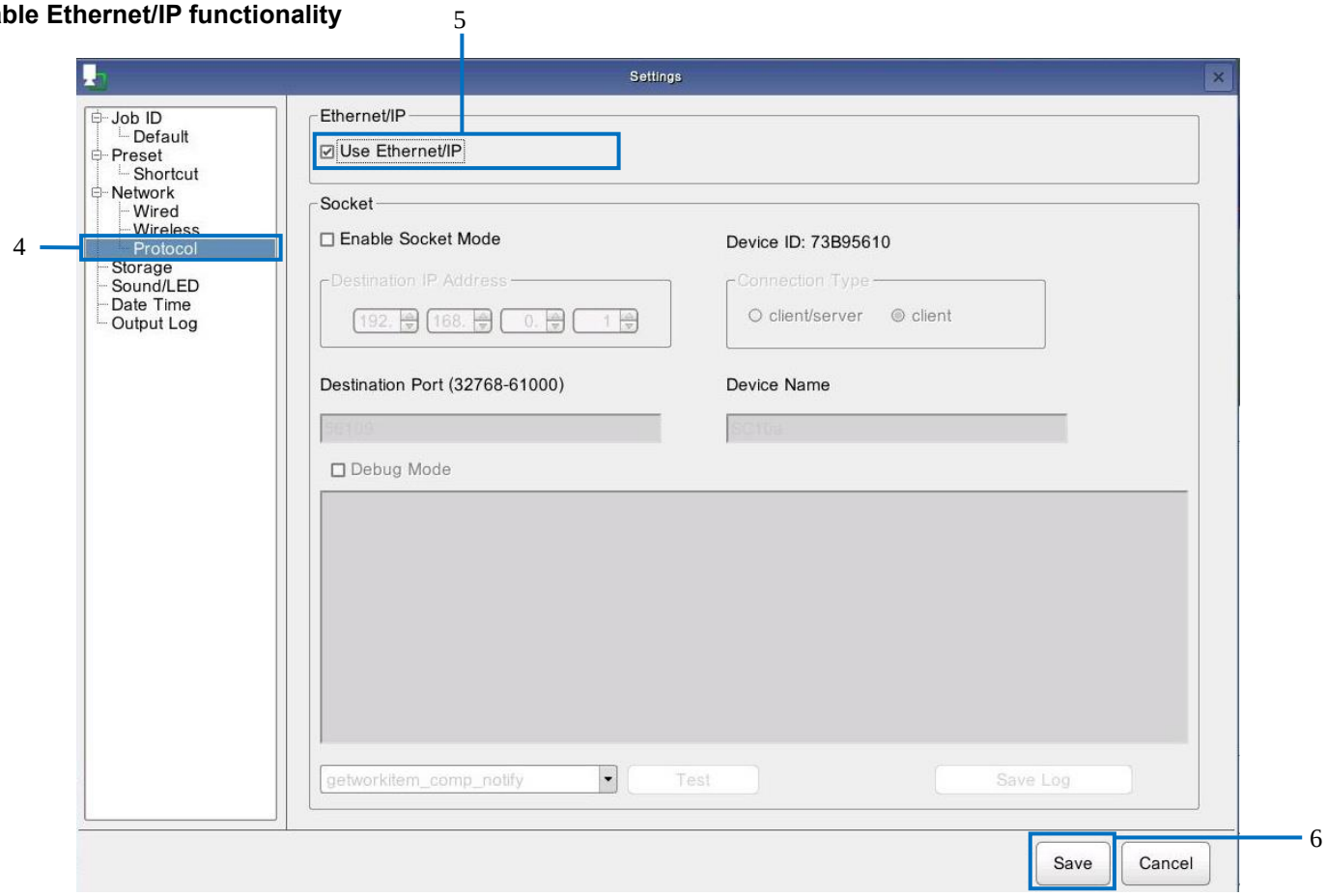
- For details on operation of the SC-10A, refer to the operating instructions of the SC-10 series.

Set the IP address



1. **Select [Wire].**
2. **Select [DHCP OFF].**
3. **Enter the Static IP Address.**

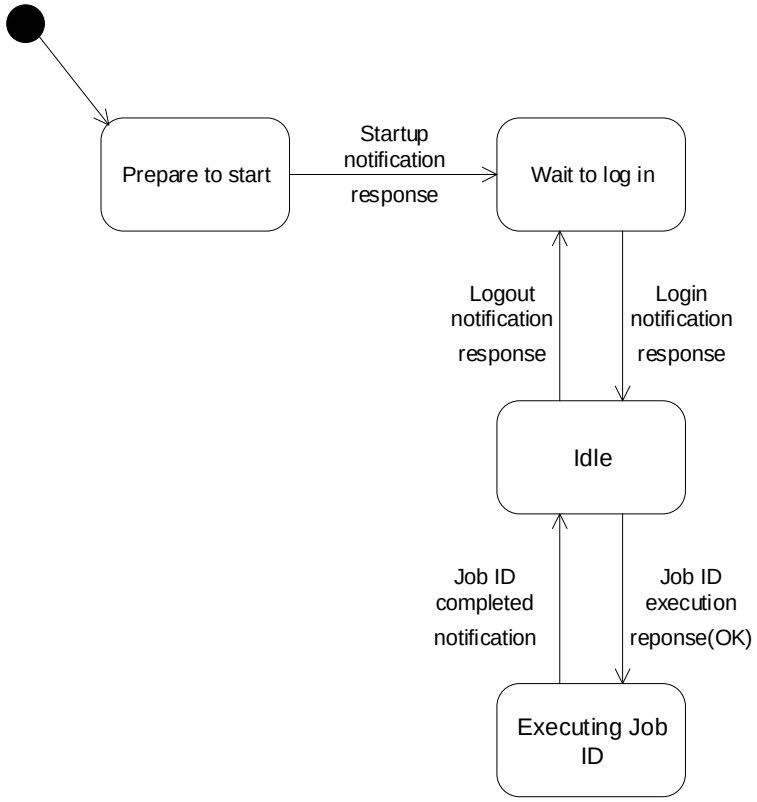
Enable Ethernet/IP functionality



4. **Select [Protocol].**
5. **Select the [Use EtherNet/IP] check box.**
6. **Click [Save].**
   The settings are saved.

7. **Restart is performed.**

Status Transition Diagram



3. Communication method

This section describes the communication format used for EtherNet/IP.

3.1 EDS (Electronic Data Sheets) file

An EDS (Electronic Data Sheets) file is an ASCII text file that describes the functionality of an EtherNet/IP™ device and is used in software tools for devices and network configurations.
The EDS files required for the EtherNet/IP™ protocol for industry networks can be downloaded from the website.
（https://industry.ricoh.com/en/support/fa_camera_lens/download/soft/）

3.2 Cyclic Communication

3.2.1 Message Specification (Cyclic: Master→Slave)

Output Data
Data size: 40 bytes

Message Format

Address	Bit																															
	31 (MSB)												16	15																		(LSB)0
0x0000													CHG JOB ID NG OFF	NG OFF	OK OFF	ALL RESET											RESTART	EXTIN3	EXTIN2	EXTIN1	STOP	START	CHG JOB ID
0x0004	Job ID																															
0x0024	Reserve																															

Address	Size	Attribute	Field name	Description
0x0000 [0]	1bit	BOOL	CHG JOB ID	0: CHG JOB ID OFF 1: CHG JOB ID ON *1
0x0000 [1]	1bit	BOOL	START	0: START OFF 1: START ON *1
0x0000 [2]	1bit	BOOL	STOP	0: STOP OFF 1: STOP ON
0x0000 [3]	1bit	BOOL	EXTIN1	0: EXTIN1 OFF 1: EXTIN1 ON
0x0000 [4]	1bit	BOOL	EXTIN2	0: EXTIN2 OFF 1: EXTIN2 ON
0x0000 [5]	1bit	BOOL	EXTIN3	0: EXTIN3 OFF 1: EXTIN3 ON
0x0000 [6]	1bit	BOOL	RESTART	Sets allocation of restart position for Job ID in stop. 0: Start from the beginning of the Job ID 1: Start from Item of NG or Stopped Job ID
0x0000 [15-7]	9bit	-	Reserve	Disuse
0x0000 [16]	1bit	BOOL	ALL RESET	All OK/NG/CHG JOB ID flags are OFF.
0x0000 [17]	1bit	BOOL	OK OFF	Turn OK flag OFF
0x0000 [18]	1bit	BOOL	NG OFF	Turn off the NG flag
0x0000 [19]	1bit	BOOL	CHG JOB ID NG OFF	Turn off the CHG JOB ID NG flag
0x0000 [31-20]	12bit	-	Reserve	Disuse
0x0004	32Byte	Char	Job ID	Only alphanumeric characters are valid. Up to 30 characters.
0x0024	4Byte	Char	Reserve	Disuse

*1: The Job ID field contains data.

3.2.2 Message specification (cyclic: Slave→Master)

Input Data
Data size: 8 bytes

Message Format

Address	Bit																													
	31 (MSB)															16	15													(LSB)0
0x0000			EXTIN3	EXTIN2	EXTIN1	STOP	START	CHG JOB ID					NG(OS)	OK(OS)	NG	OK							CHG JOB ID NG	Power supply				Job ID is being	IDLE	Before login	Before startup
0x0004	Reserve																													

Address	Size	Attribute	Field name	Description
0x0000 [3-0]	4bit	-	Camera status	[0]: Before startup [1]: Before login [2]: IDLE [3]: Execution of the Job ID
0x0000 [7-4]	4bit	-	Reserve	Disuse
0x0000 [8]	1bit	-	Power supply status	0: OFF 1: ON
0x0000 [9]	1bit		CHG JOB ID NG	0: Normal 1: Error
0x0000 [15-10]	6bit	-	Reserve	Disuse
0x0000 [19-16]	4bit	-	Judgment result	[16]: OK [17]: NG [18]: OK(OneShot) [19]: NG(OneShot)
0x0000 [23-20]	4bit	-	Reserve	Disuse
0x0000 [29-24]	6bit	-	External IO area (Output)	[24]: CHG JOB ID [25]: START [26]: STOP [27]: EXTIN1 [28]: EXTIN2 [29]: EXTIN3
0x0000 [31-30]	2bit	-	Reserve	Disuse
0x0004	4Byte	Char	Reserve	Disuse

3.3 Class object

The SC-10A Ethernet/IP defines the following standard/optional/proprietary class objects.
For other standard class objects, refer to the Ethernet/IP specification.

Object name	Class Code	Description
Identity	0x01	Provides product identification information.
Message Router	0x02	Omission
Assembly	0x04	Omission
Connection Manager	0x06	Omission
TCP/IP Interface	0xF5	Provides an interface for a TCP/IP network.
Ethernet Link	0xF6	IEEE 802.3 provides information about communication interfaces.
Quality of Service	0x48	Provides information about Ethernet frame precedence.
Camera Object	**0x7F**	**Product-specific objects**

3.3.1 Camera Object(0x7F)

Service code

Service code	Name	Description
0x0E	Get_Attribute_Single	Read out of attribute.
0x10	Set_Attribute_Single	Writing Attribute.
0x32	START	Work started. The Job ID (string) is required as additional data. The initial Job ID of SC-10A is "Default".
0x33	STOP	Work was discontinued.
0x34	EXTIN	External input. 1 BYTE is required as additional data. Added data = 0x00 to 0x07
0x35	SHUTDOWN	Shutdown.

Attribute

Instance ID	Attribute	Name	Access Control	Data type	Description
0	1	Revision	Get	UINT	0001h (Object revision)
0	2	MaxInstance	Get	UINT	Maximum instance number (16)
0	3	Number of instances	Get	UINT	Maximum instance number (16)
1-13	1	Parameter Value	Get/Set	*1	Retrieves and sets the values for each instance.
1-13	2	Descriptor	Get	USINT	0x00:Get Only 0x01:Set/Get
1-13	3	Data Type	Get	USINT	Data type code: BOOL(0xC1) USINT(0xC6) UINT(0xC7) STRING(0xD0)
1-13	4	No. of Elements	Get	USINT	Number of elements of each data type
1-13	5	Parameter Name String	Get	SHORT-STRING	Parameter name
1-13	6	Help String	Get	SHORT-STRING	Description of the instance
1-13	7	Minimum Value	Get	*1	Minimum value
1-13	8	Maximum Value	Get	*1	Maximum value
1-13	9	Default Value	Get	*1	Specified value

* 1 instance attribute 3 (Data Type)×4 (No. of Elements) size

※ SHORT-STRING means that the first byte contains the size (number of characters) and subsequent characters (no null)

Instance ID	Parameter name	Data type	Number of elements	Value Access Type
0		-	-	-
1	Camera State	USINT	1	Get
2	Power State	BOOL	1	Get
3	Matching Result	USINT	1	Get
4	JobID	STRING	64	Set/Get
5	White Balance R	UINT	1	Set/Get
6	White Balance G	UINT	1	Set/Get
7	White Balance B	UINT	1	Set/Get
8	Sensor Shutter	UINT	1	Set/Get
9	Sensor Gain	UINT	1	Set/Get
10	Sensor Flip	BOOL	1	Set/Get
11	Auto Exposure	BOOL	1	Set/Get
12	Beep Sound	USINT	1	Set/Get
13	Audio Mode	BOOL	1	Set/Get
14	Audio Volume	USINT	1	Set/Get
15	LED Mode	USINT	1	Set/Get

- **For each instance ID**

Instance ID	Parameter name	Description		
1	Camera State	Get the camera status.		
Data type	**Number of elements**	**Minimum/Max/Default**	**Access Type**	**EDS notation**
USINT	1	0/15/0	Get	[0]: Sleeping [1]: Log off [2]: IDLE [3]: Job Matching

Instance ID	Parameter name	Description		
2	Power State	Get the startup status.		
Data type	**Number of elements**	**Minimum/Max/Default**	**Access Type**	**EDS notation**
BOOL	1	0/1/0	Get	0: Power OFF 1: Power ON

Instance ID	Parameter name	Description		
3	Matching Result	Get the judgment result.		
Data type	**Number of elements**	**Minimum/Max/Default**	**Access Type**	**EDS notation**
USINT	1	0/1/1	Get	0: Matching OK 1: Matching NG

Instance ID	Parameter name	Description		
4	Job ID	Set/ Get the current Job ID.		
Data type	**Number of elements**	**Minimum/Max/Default**	**Access Type**	**EDS notation**
STRING	64	0/64/Default	Set/Get	

Instance ID	Parameter name	Description		
5	White Balance R	Set/Get the white balance R value.		
Data type	**Number of elements**	**Minimum/Max/Default**	**Access Type**	**EDS notation**
UINT	1	0/384/128	Set/Get	

Instance ID	Parameter name	Description		
6	White Balance G	Set/Get the white balance G value.		
Data type	**Number of elements**	**Minimum/Max/Default**	**Access Type**	**EDS notation**
UINT	1	0/384/128	Set/Get	

Instance ID	Parameter name	Description		
7	White Balance B	Set/Get the white balance B value.		
Data type	**Number of elements**	**Minimum/Max/Default**	**Access Type**	**EDS notation**
UINT	1	0/384/128	Set/Get	

Instance ID	Parameter name	Description		
8	Sensor Shutter	Set/Get shutter speed.		
Data type	**Number of elements**	**Minimum/Max/Default**	**Access Type**	**EDS notation**
UINT	1	0/672/128	Set/Get	

Instance ID	Parameter name	Description		
9	Sensor Gain	Set/Get gain value.		
Data type	**Number of elements**	**Minimum/Max/Default**	**Access Type**	**EDS notation**
UINT	1	0/255/16	Set/Get	

Instance ID	Parameter name	Description		
10	Sensor Flip	Set/Get reversed image.		
Data type	**Number of elements**	**Minimum/Max/Default**	**Access Type**	**EDS notation**
BOOL	1	0/1/0	Set/Get	0: Flip OFF 1: Flip ON

Instance ID	Parameter name	Description		
11	Auto Exposure	Set/Get automatic exposure adjustment.		
Data type	**Number of elements**	**Minimum/Max/Default**	**Access Type**	**EDS notation**
BOOL	1	0/1/0	Set/Get	0: Auto Exposure OFF 1: Auto Exposure ON

Instance ID	Parameter name	Description		
12	Beep Sound	Set/Get the beep volume.		
Data type	**Number of elements**	**Minimum/Max/Default**	**Access Type**	**EDS notation**
USINT	1	0/2/0	Set/Get	0: None 1: Low 2: High

Instance ID	Parameter name	Description		
13	Audio Mode	Set/Get USB audio mode.		
Data type	**Number of elements**	**Minimum/Max/Default**	**Access Type**	**EDS notation**
BOOL	1	0/1/0	Set/Get	0: Disable 1: Enable

Instance ID	Parameter name	Description		
14	Audio Volume	Set/Get the volume of USB audio.		
Data type	**Number of elements**	**Minimum/Max/Default**	**Access Type**	**EDS notation**
USINT	1	0/100/0	Set/Get	

Instance ID	Parameter name	Description		
15	LED Mode	Set/Get LED lighting mode.		
Data type	**Number of elements**	**Minimum/Max/Default**	**Access Type**	**EDS notation**
USINT	1	0/1/0	Set/Get	0: OneShot 1: Keep

3.3.2 Identity Object(0x01)

Service code

Service code	Name
0x01	Get_Attribute_All
0x05	Reset
0x0E	Get_Attribute_Single

Attribute

Instance ID	Attribute	Name	Access Control	Data type	Description
0	1	Revision	Get	UINT	Revision of the Identity object
0	2	Max Instance	Get	UINT	Maximum instance number
1	1	Vendor ID	Get	UINT	Product vendor identification number
1	2	Device Type	Get	UINT	General device classification
1	3	Product Code	Get	UINT	Product identification
1	4	Revision	Get	Framework	Revision number of product
1	5	Status	Get	WORD	Device communication status
1	6	Serial Number	Get	UDINT	Vendor-specific product identification number
1	7	Product Name	Get	SHORT_STRING	Product name
1	8	State	Get	USINT	Device state 0 = Nonexistent 1 = Device Self Testing 2 = Standby 3 = Operational 4 = Major Recoverable Fault 5 = Major Unrecoverable Fault 255 = Default Value

Reset service

Data	Description
0x00	Execute the same operation as power reset. This is the default operation when data is omitted.
0x01	Perform the same operation as the power reset after returning to the default setting.

3.3.3 TCP/IP Interface (0xF5)

Service code	Name
0x01	Get_Attribute_All
0x0E	Get_Attribute_Single
0x10	Set_Attribute_Single

Instance ID	Attribute	Name	Access Control	Data type	Description
0	1	Revision	Get	UINT	Revision of the TCP/IP Interface object
0	2	Max Instance	Get	UINT	Maximum instance number
1	1	Status	Get	DWORD	TCP/IP network status Bit0-3: Interface Configuration Status 1 = establishment by BOOTP, DHCP, or NV 2 = establishment by rotary switch Bit 4-31: fixed at 0
1	2	Configuration Capability	Get	DWORD	Setting function Bit0: BOOTP Client Bit1: Reserved Bit2: DHCP Client Bit3: Reserved Bit4: Configuration Settable Bit5: Hardware Configurable Bit6: Reserved Bit7: ACD Capable Bit8-31: Reserved
1	3	Configuration Control	Get/Set	DWORD	IP addressing method Bit0-3: Configuration Method 0 = fixed IP address 1 = BOOTP 2 = DHCP Bit 4-31: fixed at 0
1	4	Physical Link Object	Get	Framework	Path to the physical-layer link object
1	5	Interface Configuration	Get/Set	Framework	TCP/IP network settings
1	6	Host Name	Get/Set	STRING	Host name
1	8	TTL Value	Get/Set	USINT	Time to Live for multicast
1	9	Mcast Config	Get/Set	Framework	Multicast addressing
1	10	SelectAcd	Get/Set	BOOL	ACD enabled/disabled
1	11	Last ConflictDetected	Get/Set	Framework	The last competition information found

3.3.4 Ethernet Link (0xF6)

Service code	Name
0x01	Get_Attribute_All
0x0E	Get_Attribute_Single
0x10	Set_Attribute_Single

Instance ID	Attribute	Name	Access Control	Data type	Description
0	1	Revision	Get	UINT	Revision of the Ethernet Link object
0	2	Max Instance	Get	UINT	Maximum instance number
1-2	1	Interface Speed	Get	UDINT	Communication speed of TIN port
1-2	2	Interface Flags	Get	DWORD	IN port status
1-2	3	Physical Address	Get	DWORD	MAC address
1-2	4	Interface Counters	Get	Framework	Number of packets sent and received on the interface
1-2	5	Media Counters	Get	Framework	Ethernet media counter
1-2	6	Interface Control	Get/Set	Framework	Control of the interface
1-2	7	Interface Type	Get	USINT	Type of physical interface
1-2	8	Interface State	Get	USINT	Interface state
1-2	9	Admin State	Get/Set	USINT	Enabling/disabling interfaces
1-2	10	Interface Label	Get	SHORT_STRING	Interface's distinguished name

3.3.5 Quality of Service (0x48)

Service code	Name
0x0E	Get_Attribute_Single
0x10	Set_Attribute_Single

Instance ID	Attribute	Name	Access Control	Data type	Description
0	1	Revision	Get	UINT	Revision of the Quality of Service object
0	2	Max Instance	Get	UINT	Maximum instance number
1	5	DSCP Scheduled	Get/Set	USINT	CIP transport class 0/1 message Scheduled priority
1	8	DSCP Explicit	Get/Set	USINT	Precedence of UCMM CIP transport class 2/3 Other messages

Revision history

Version Rev.	Date of preparation Date	Editorial revision Changes	Remarks Note
1.00	2020/06/18	New issuance	