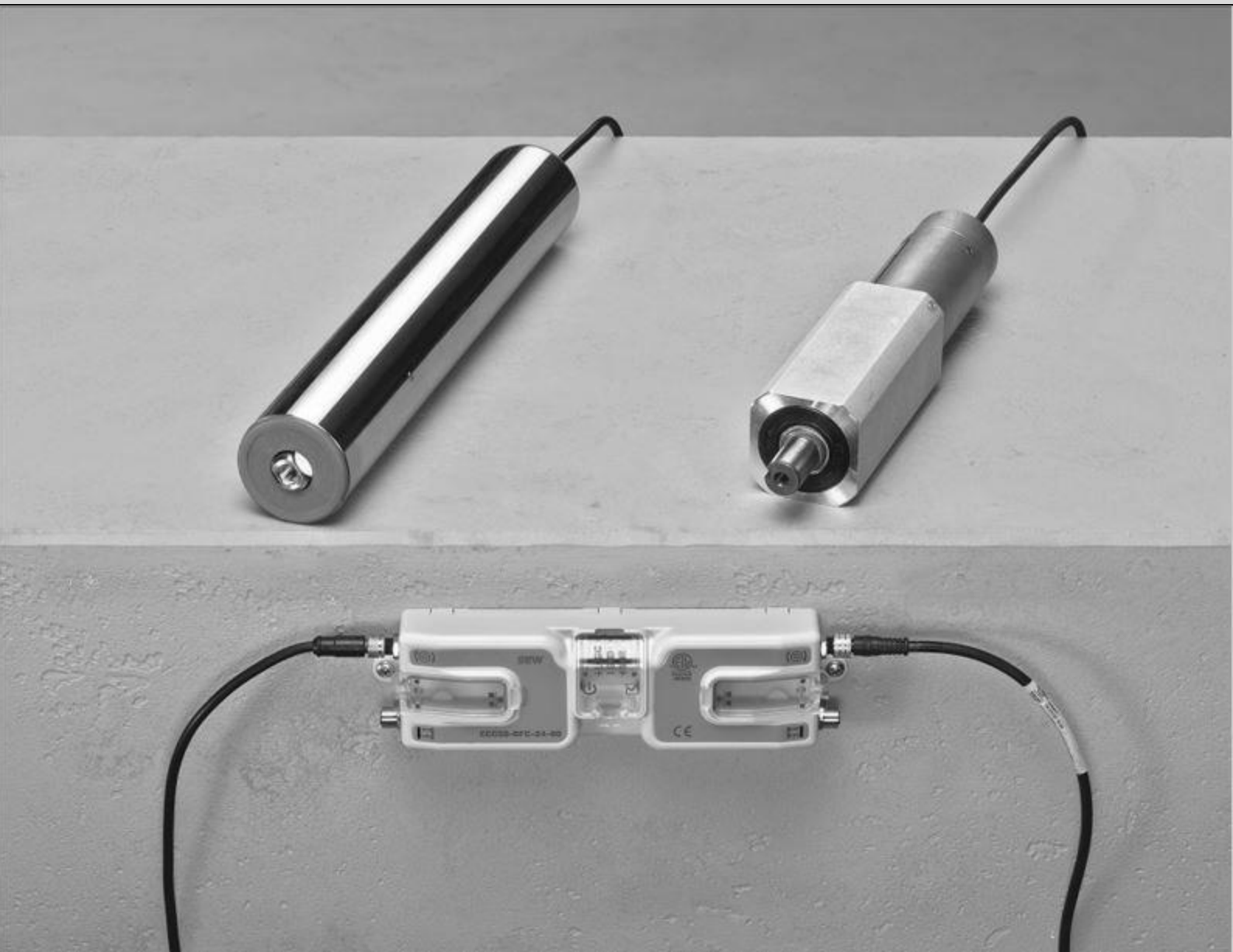


Manual



ECDriveS®
IO-Module ECIO-8-24-00



This documentation has been prepared based on current results. Future communications may differ if new facts come to light. As a result, the possibility of misinterpretations or mistakes in the technical data cannot be ruled out.

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1 General information

1.1 How to use this documentation

This documentation is an integral part of the product. The documentation is intended for all employees who perform assembly, installation, startup and service work on the product.

Make sure this documentation is accessible and legible. Ensure that persons responsible for the systems and their operation as well as persons who work on the product independently have read through the documentation carefully and understood it. If you are unclear about any information or if you require further information, contact SEW-EURODRIVE.

1.2 Structure of the safety notes

1.2.1 Meaning of signal words

The following table shows the graduation and meaning of the signal words for safety notes.

Signal word	Meaning	Consequences if disregarded
▲ DANGER	Imminent danger	Severe or fatal injuries
▲ WARNING	Possible dangerous situation	Severe or fatal injuries
▲ CAUTION	Possible dangerous situation	Minor injuries
NOTICE	Possible damage to property	Damage to the drive system or its environment
INFORMATION	Useful information or tip: Simplifies the handling of the drive system.	

1.2.2 Structure of section-related safety notes

Section-related safety notes do not apply to a specific action but to several actions pertaining to one subject. The hazard symbols used indicate either a general hazard or a specific hazard.

This is the formal structure of a safety note for a specific section:



▲ SIGNAL WORD!

Type and source of danger.

Possible consequence(s) if disregarded.

- Measure(s) to prevent danger.

Meaning of the hazard symbols

The hazard symbols in the safety notes have the following meaning:

Hazard symbol	Meaning
	General hazard
	Warning of dangerous electric voltage
	Warning of hot surfaces
	Warning of risk of crushing
	Warning about suspended load
	Warning of automatic startup

1.2.3 Structure of embedded safety notes

Embedded safety notes are directly integrated into the instructions just before the description of the dangerous step.

This is the formal structure of an embedded safety note:

▲ SIGNAL WORD! Type and source of danger. Possible consequence(s) if disregarded.
Measure(s) to prevent danger.

1.3 Rights to claim under limited warranty

Read the information in this documentation. This is essential for error-free operation and fulfillment of any rights to claim under limited warranty. Read the documentation before you start working with the product.

1.4 Other applicable documentation

- Operating Instructions - ECDriveS® ECC-DFC Fieldbus Controller, ECR Roller Drives, ECG Gearmotors
- Manual ECDriveS® PROFINET IO Interface ECC-DFC

1.5 Product names and trademarks

All product names in this documentation are trademarks or registered trademarks of their respective titleholders.

1.6 Copyright notice

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2 Safety notes

2.1 Preliminary information

The following basic safety notes are used for the avoidance of injuries and property damage, and they refer primarily to the use of the products documented here. If you also use other components, also observe the warnings and safety notes that apply to them.

2.2 Duties of the user

As the user, you must ensure that the basic safety notes are observed and complied with. Make sure that persons responsible for the machinery and its operation as well as persons who work on the device independently have read through the documentation carefully and have understood it. If you are unclear about any information or if you require further information, contact SEW-EURODRIVE.

As the user, you must ensure that all of the work is only carried out by qualified specialists.

Ensure that the persons who work on the product pay attention to the following regulations, conditions, documentation, and information:

- National and regional safety and accident prevention regulations
- Warning and safety signs on the product
- All other associated project planning documents, installation notes, startup instructions, wiring diagrams, and wiring plans
- Do not assemble, install or operate damaged products
- All system-specific specifications and regulations

Ensure that systems in which the product is installed are equipped with additional monitoring and protection devices. Observe the applicable safety regulations and legislation governing technical work equipment and accident prevention regulations.

2.3 Target Group

Any mechanical work may only be performed by adequately qualified specialists. Specialists in the context of this documentation are persons familiar with the design, mechanical installation, troubleshooting, and maintenance of the product who possess the following qualifications:

- Qualification in the field of mechanical engineering in accordance with the national regulations
- Familiarity with this documentation

Any electronic work may only be performed by adequately electrically skilled persons. Qualified electricians in the context of this documentation are persons familiar with electrical installation, startup, troubleshooting, and maintenance of the product who possess the following qualifications:

- Qualification in the field of electrical engineering in accordance with the national regulations

- Familiarity with this documentation

In addition to that, these persons must be familiar with the valid safety regulations and laws, as well as with the requirements of the standards, directives, and laws specified in this documentation. The above-mentioned persons must have the express authorization of the company to operate, program, configure, label and ground units, systems and circuits in accordance with the standards of safety technology.

All work in the areas of transportation, storage, operation and waste disposal must be carried out by persons who are trained appropriately. These instructions must enable the persons to carry out the required activities and work steps safely and in accordance with regulations.

2.4 Designated use

The product is intended for installation in electrical systems or machines.

In case of installation in electrical systems or machines, startup of the product is prohibited until it is determined that the machine meets the requirements stipulated in the local laws and directives. For Europe, Machinery Directive 2006/42/EC as well as the EMC Directive 2014/30/EU apply. Observe EN 60204-1 (Safety of machinery – electrical equipment of machines). The product meets the requirements stipulated in the Low Voltage Directive 2014/35/EU.

The standards given in the declaration of conformity apply to the product.

Technical data and information on the connection conditions are provided on the nameplate and in chapter "Technical data" in the documentation. Always comply with the data and conditions.

Unintended or improper use of the product may result in severe injury to persons and damage to property.

2.5 Functional safety technology

If the documentation does not expressly permit it, the product must not perform any safety functions without supervisory safety systems.

2.6 Transport

Inspect the shipment for damage as soon as you receive the delivery. Inform the shipping company immediately about any damage. If the product is damaged, it must not be assembled, installed or started up.

Observe the following notes during transportation:

- Ensure that the product is not subject to mechanical impact during transportation.
- Cover the connectors with the supplied protective caps before transportation.
- Only place the product on the cooling fins or on the side without connectors during transportation.
- Always use lifting eyes if available.

If necessary, use suitable, sufficiently dimensioned handling equipment.

Observe the information on climatic conditions in chapter "Technical data" of the documentation.

2.7 Storage

Observe the following instructions when shutting down or storing the units:

- Make sure that the unit is not subject to mechanical impact during storage.
- In the case of extended storage periods, connect the unit to the line voltage for at least 5 minutes every 2 years.
- Observe the notes on storage temperature in chapter "Technical data".

2.8 Installation/assembly

Ensure that the product is installed and cooled according to the regulations in the documentation.

Protect the product from strong mechanical strain. The product and its mounting parts must never protrude into the path of persons or vehicles. Ensure that components are not deformed and insulation spaces are not changed, particularly during transportation and handling. Electric components must not be mechanically damaged or destroyed.

2.8.1 Restrictions of use

The following applications are prohibited unless the device is explicitly designed for such use:

- Use in potentially explosive atmospheres.
- Use in areas exposed to harmful oils, acids, gases, vapors, dust, and radiation.
- Operation in applications with impermissibly high mechanical vibration and shock loads in excess of the regulations stipulated in EN 61800-5-1.
- Use at an elevation of more than 4000 m above sea level.
- The product can be used at altitudes above 1000 m above sea level up to 4000 m above sea level under the following conditions:
- Taking the reduced continuous rated current into consideration, see chapter "Technical data" of the documentation.
- Above 2000 m above sea level, the air and creeping distances are only sufficient for overvoltage class II according to EN 60664.
- If the installation requires overvoltage category III according to EN 60664 you have to reduce the overvoltages on the system side from category III to II using additional external overvoltage protection.
- If a protective electrical separation is required, then implement this outside the product at altitudes of more than 2000 m above sea level (protective separation in accordance with EN 61800-5-1 and EN 60204-1)

2.9 Electrical connection

Familiarize yourself with the applicable national accident prevention regulations before working on the product.

Perform electrical installation according to the pertinent regulations (e.g. cable cross-sections, fusing, protective conductor connection). The documentation at hand contains additional information.

Ensure that all of the required covers are correctly attached after the electrical installation.

Make sure that preventive measures and protection devices comply with the applicable regulations (e.g. EN 60204-1 or EN 61800-5-1).

2.10 Startup/operation

Do not deactivate monitoring and protection devices of the machine or system even for a test run.

Ensure that the connection boxes are closed and screwed down before applying the supply voltage.

Depending on the degree of protection, products may have live, uninsulated, and sometimes moving or rotating parts, as well as hot surfaces during operation.

Additional preventive measures may be required for applications with increased hazard potential. Be sure to check the effectiveness of the protection devices after every modification.

In the event of deviations from normal operation, switch the product off. Possible deviations are increased temperatures, noise, or vibration, for example. Determine the cause. It may be necessary to contact SEW-EURODRIVE.

Do not separate the connection to the product during operation.

The fact that the operation LED and other display elements are no longer illuminated does not indicate that the product has been disconnected from the supply system and no longer carries any voltage.

Mechanical blocking or internal safety functions of the product can cause a motor standstill. Eliminating the cause of the problem or performing a reset may result in the drive restarting automatically. If this is not permitted for the drive-controlled machine for safety reasons, first disconnect the product from the supply system and then start troubleshooting.

Risk of burns: The surface temperature of the product can exceed 60 °C during operation. Do not touch the product during operation. Let the product cool down before touching it.

2.11 Inspection/maintenance

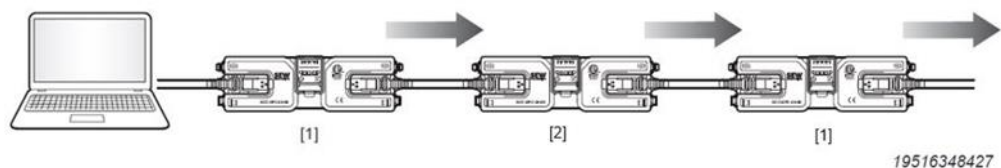
Exposed, live parts inside the unit. Never open the unit. Repair work may only be carried out by SEW-EURODRIVE.

3 Product description

The ECDriveS® 24 V drive system by SEW-EURODRIVE consists of a brushless gear-motor that can be directly integrated into a conveyor roller, or be universally used as gearmotor.

ECDriveS® control system as applied to conveyor control or some other industrial application is a series of ECIO and ECC-DFC modules interconnected via standard Ethernet cabling. A network of ECC-DFC modules are primarily used as ZPA conveyor controllers. ECIO is available to allow you to place digital IO on the same network along with ECC-DFC conveyor control modules.

Each ECIO control module is equipped with up to 8 digital inputs / 8 digital outputs. ECIO modules can optionally be easily configured with the ECShell software to be “transparent” to the conveyor flow to ensure that ZPA conveyor is uninterrupted from upstream to downstream



[1] Fieldbus module ECC-DFC

[2] IO-Module ECIO

ECDriveS® Network with two fieldbus modules ECC-DFC and one ECIO-Module

Each individual ECIO module has the following features:

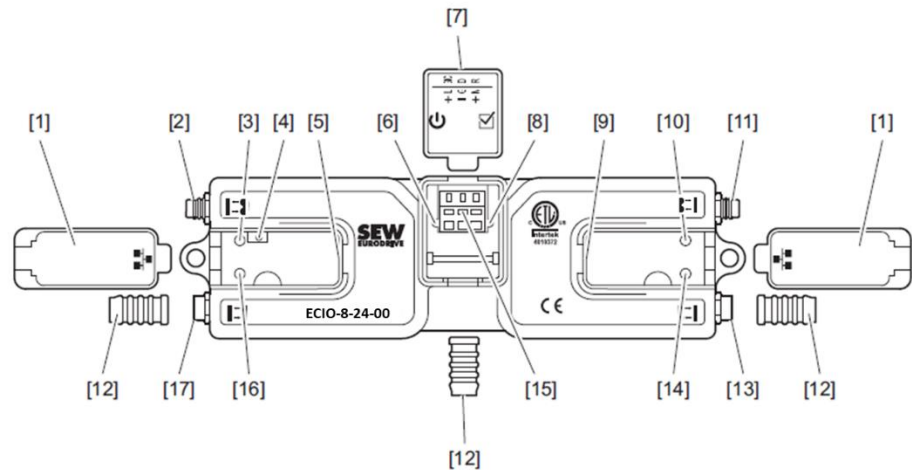
- Built-in Ethernet switch
- Modular M8 (female) style connection ports for I/O
- Modular M8 (male) style connection ports for I/O
- 24VDC power connection with separate power supplies for logic and outputs
- Context-sensitive multi-color LED indicators
- Programmable option for push-pull type input devices
- IP54 compliant

3.1 Type designation

- ECC-DFC-24-00: Fieldbus motor control module
- ECIO-8-24-00: I/O-Module
- ECShell: Engineering-Software

3.2 Basic device

The following figure shows the device structure:



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- [1] Removable IP54 Power Compartment Cover
- [2] und [11] Left & Right Male 4-pin M8 style connector for I/O connections
- [3] und [10] Left Male & Right Male I/O Port Status LED indicators
- [4] Module Replacement Button
- [5] und [9] Link Left and Link Right – RJ-45 style Ethernet network connection
- [6] Module Power LED Indicator
- [7] Removable IP54 Power Compartment Cover
- [8] Module Status LED Indicator
- [12] IP54 Protection Shrouds for Ethernet cabling and power wiring
- [15] 24VDC Power Terminals with separate connections for Logic and Outputs
- [16] und [14] Left Female & Right Female I/O Port Status LED Indicators
- [17] und [13] Left Female & Right Female I/O Port Status LED Indicators

INFORMATION



The “left” and “right” naming convention for the module ports is based upon facing the module as shown.

4 Mechanical installation

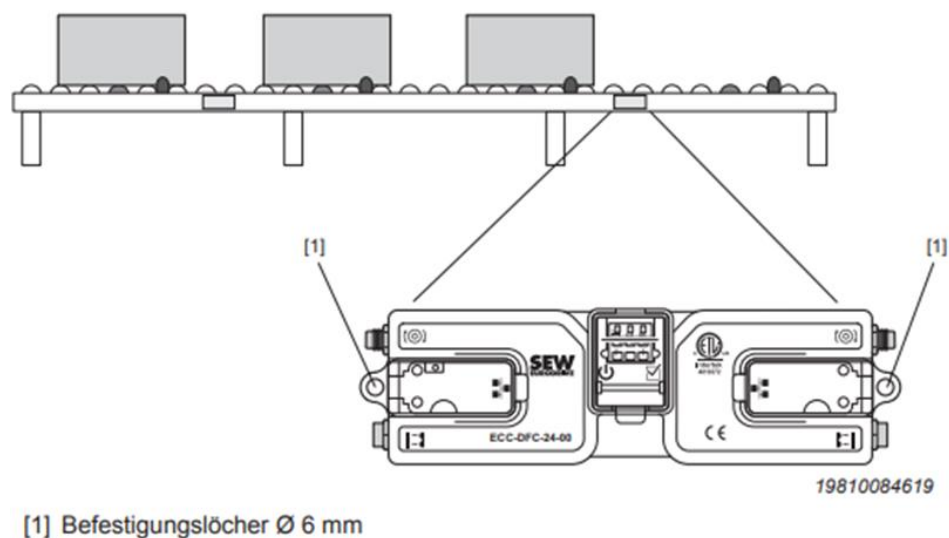
4.1 General information

Observe the following points for mechanical installation:

- Information about permitted conditions at the place of installation
- Suitable mounting elements and retaining components
- Make sure there is no risk of collisions with other components or construction elements along the track.
- Installed display and diagnostics components such as LEDs, displays, and diagnostic interfaces must be accessible and easy to see.

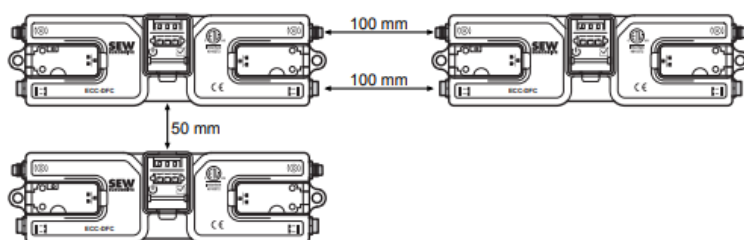
4.2 Mounting

Each module has 2 holes [1] for mounting purposes. The holes have a diameter of 6 mm.



4.3 Clearance

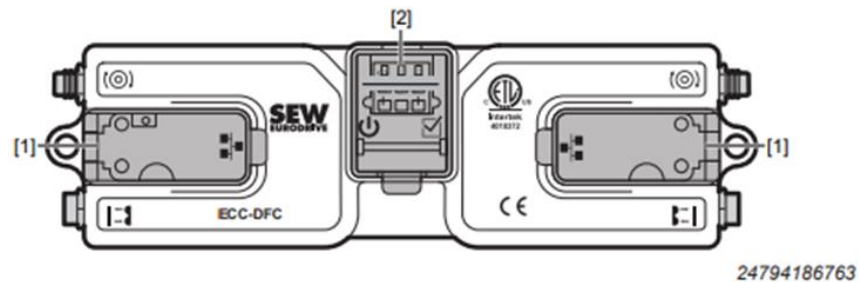
During mechanical installation, observe the minimum clearances:



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4.4 Covers

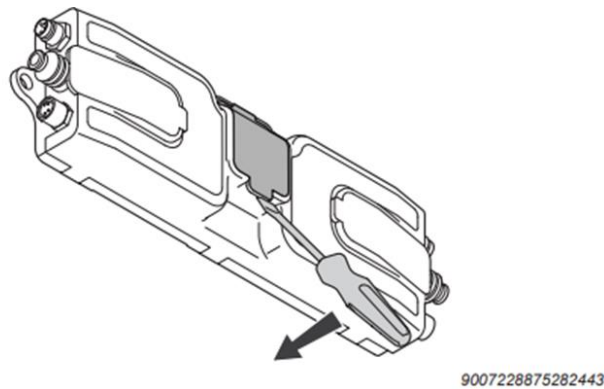
The module has 3 covers to ensure the IP degree of protection



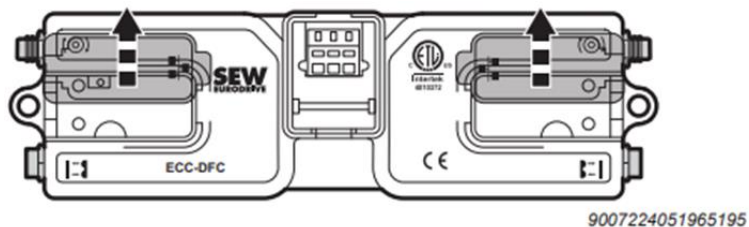
- [1] Cover Ethernet port
- [2] Cover supply terminal

Removing the covers

1. To remove the cover from the supply terminal, lever out the cover using a screwdriver.



2. To remove the cover from the Ethernet port, pull the covers away from the fieldbus controller.



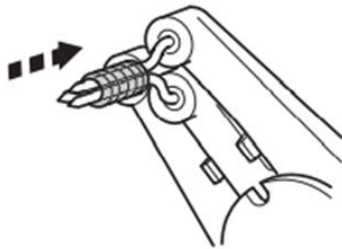
4.5 Ensuring IP54 degree of protection

To ensure IP54 degree of protection for the ECC-DFC fieldbus controller, the following requirements must be met:

- All covers are tightened.
- All connection cables are equipped with protective grommets.
- All unused connectors are closed using a protection cap

Assembling protective grommets

To assemble protective grommets, suitable assembly tools are required, such as SES-Sterling sleeve expander tool KY2 for max. cable Ø 9.0 mm., Manufacturer number: 04100137000 (not included in the scope of delivery)



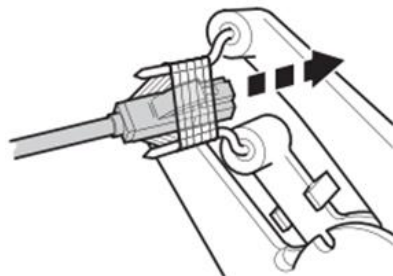
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1. Pull the protective grommet over the mandrel of the assembly tool.



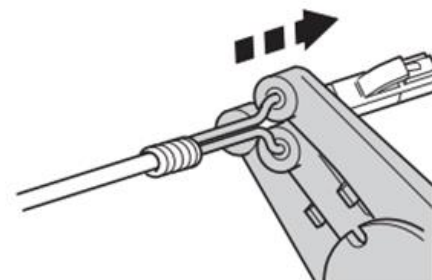
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2. To expand the protective grommet, push the handles of the assembly tool.



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3. Insert the cable (including connector) into the expanded protective grommet.



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4. To place the protective grommet on the cable jacket, hold the protective grommet in place with your hand and remove the assembly tool by pulling it out.

5 Electrical installation

5.1 Electromagnetic compatibility (EMC)

To prevent interference in the ECDriveS® drive system due to EMC influence, always route the connection cable of the 24 V control circuit separate from the control cables with inductive loads (motors, brakes, contactors etc.) and from supply system cables.

5.2 Shielding and routing bus cables



INFORMATION

All Ethernet cables for connections between modules are recommended to be shielded. Failure to use shielded cables may result in data loss and unexpected results. Shown above are Ethernet cables with sealing shrouds required for IP54 compliance.

5.3 Installation instructions

The nominal voltage of the ECDriveS® control module must correspond to the data for the supply voltage. Dimension the cable cross section of the connection cable according to the input current of the imodule (see chapter "Technical data").

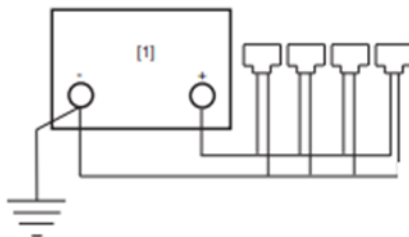
Use the ECDriveS® drive system only in systems that comply with the requirements of protection class 3 according to EN 61140, e.g. SELV.

At least one of the following means shall provide thermal overload protection of the connection lead:

- The maximum output current of the 24 V switched-mode power supply is limited to the value of the maximum current carrying capacity of the connected conductor.
- Fuses in utilization category gG
- Type C miniature circuit breaker

5.4 Grounding of switched-mode power supply

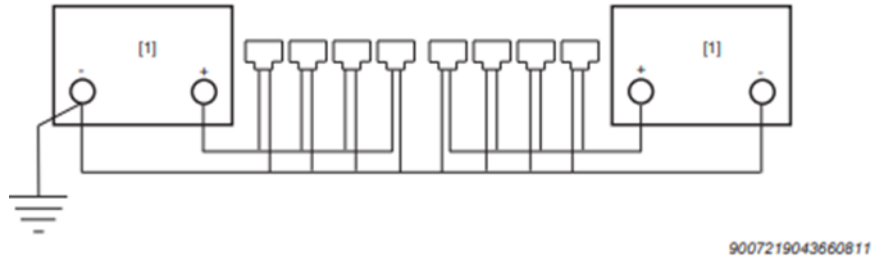
According to the requirements for a SELV system, the mass connections of the output channels must be connected with the ground potential of the switched-mode power supply (SMPS)



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[1] Switched-mode power supply

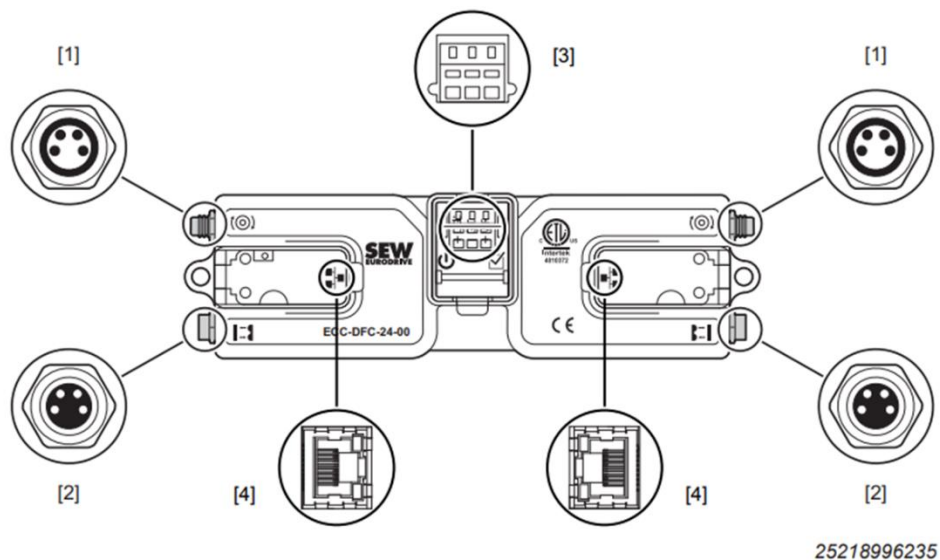
If several switched-mode power supply units are connected in parallel, the unit grounds of all supply units must be connected and the ground connection of at least one supply unit must be grounded.



[1] Switched-mode power supply

5.5 Connection overview

The ECIO module has several electric connections. The following figure shows an overview of the connections.



- [1] Sensor connection (male)
- [2] Sensor connection (female)
- [3] 24 V supply terminal
- [4] Ethernet-Port

5.5.1 Supply terminal

Function		
24 V supply terminal		
Connection type		
Cage clamp terminal		
Connection diagram		
No.	Name	Function
[1]	LOGIC+	DC 24 V supply control electronics
[2]	GND	Reference potential
[3]	MDR+	DC 24 V supply basic device

Installation instructions supply terminal

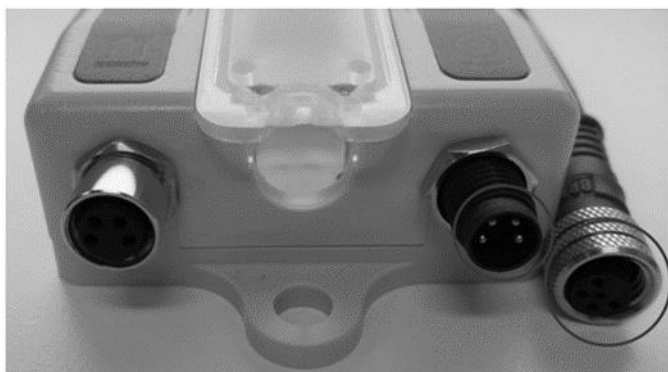
The supply terminal is designed for the following connection cross sections and current carrying capacity:

Terminal data	Value
Connection cross section	0.25 – 2.5 mm ²
Current carrying capacity (max. continuous current)	15 A
Conductor stripping length	5 – 6 mm

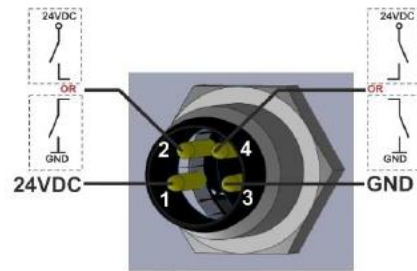
To prevent damages to the litz wires of the conductor, use conductor end sleeves for flexible conductors. The size of the conductor end sleeve depends on the cable cross section.

5.5.2 Left and right male I/O port

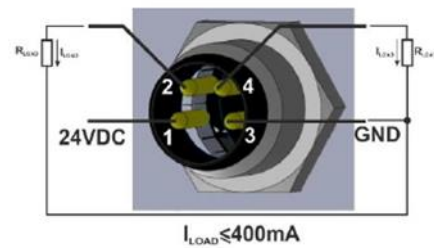
Both of these ports utilize a 4-pin M8 male receptacle. Each receptacle is mechanically keyed to assure proper orientation upon plugging in. Each of the two signal pins can be configured as a digital input or output.



Input Signal Wiring for Male Port

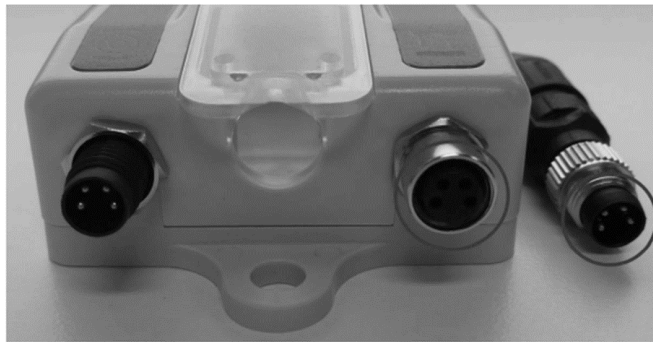


Output Signal Wiring for Male Port

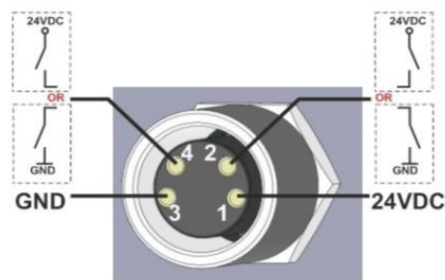


5.5.3 Left and right female I/O port

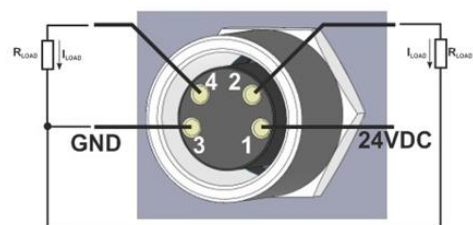
Each port is a standard M8 Female receptacle. Each receptacle is mechanically keyed to assure proper orientation upon plugging in



Input Signal Wiring for Female Port



Output Signal Wiring for Female Port



The signals are defined by the following chart:

Pin	Signal	Description
1	24V DC	Module 24VDC Supply
2	I/O	Input or Output signal based upon port configuration
3	GND	Module DC Common
4	I/O	Input or Output signal based upon port configuration

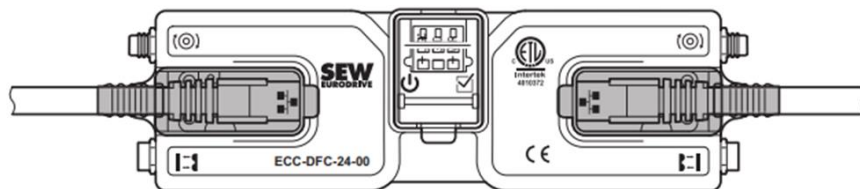
5.5.4 Ethernet-Port

Protocols		
• PROFINET IO • EtherNet/IP™ • Modbus TCP		
Connection type		
Push-pull RJ45		
Connection diagram		
		
No.	Name	Function
[1]	TX+	Transmit line (+)
[2]	TX-	Transmit line (-)
[3]	RX+	Receive line (+)
[4]	res.	Reserved
[5]	res.	Reserved
[6]	RX-	Receive line (-)
[7]	res.	Reserved
[8]	res.	Reserved

Wiring space Ethernet port

To ensure IP54 degree of protection, close off all wiring spaces of the Ethernet port with covers (see chapter "Covers").

The following figure shows the ECIO module with connected RJ45 connectors, installed covers and protective grommets

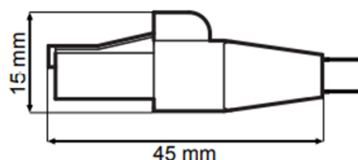


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INFORMATION

To make it possible to mount the supplied covers of the module, the connectors must be no higher than 15 mm and no longer than 45 mm.

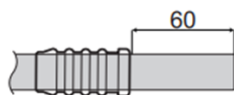


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5.6 Connecting the power supply line

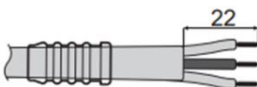
Do the following to connect the voltage supply to the supply terminal:

1. Remove the cover from the supply terminal, as described in chapter "Covers".
2. Install the protective grommet for IP54 degree of protection on the connection cable, as described in chapter "Assembling protective grommets".



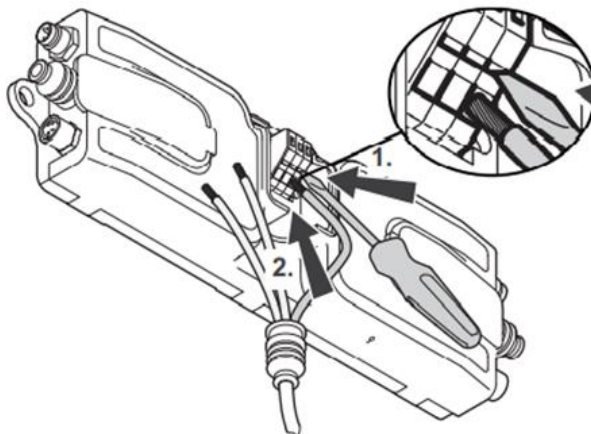
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3. Remove the cable jacket of the connection cable using suitable tools.



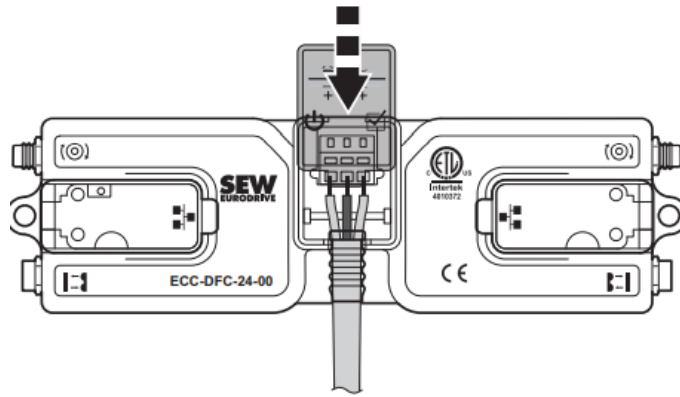
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4. Connect the connection cable to the spring terminal strip.



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5. Pull the protective grommet over the edge of the terminal chamber.



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6. Install the cover on the supply terminal.

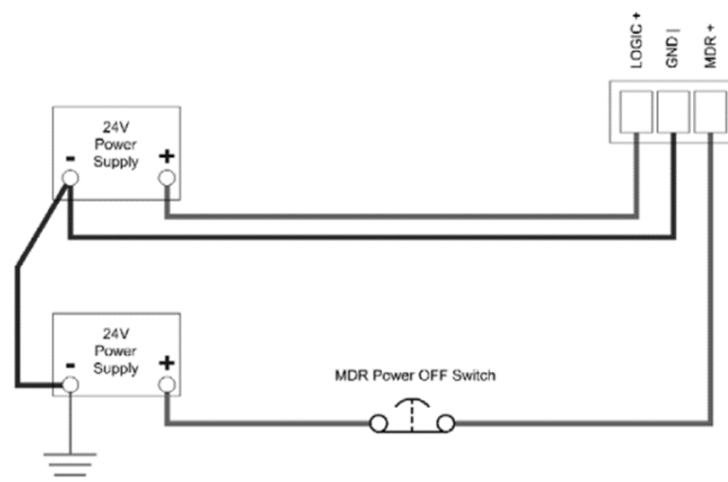
5.7 Logic and output power

The EC IO module is designed to allow for separate power connections for module logic and digital outputs power so that separate power supplies can power these. For example, the digital outputs power supply can be switched off so that all output devices have power removed. With the outputs power separately switched off, the logic power supply can remain on so that the module's communications can remain active and report status to networked supervisory control system(s).

Connection for single outputs and logic power supply:



Typical connection for separate outputs and logic power supplies:



6 Startup

In Abhängigkeit der Ansteuerung und der Anwendung werden folgende zwei Methoden zur Inbetriebnahme unterschieden:

Depending on the control and application, there are 2 possible startup methods:

1. Startup with ECShell and PLC Integration

With this startup method you can start up a conveyor line with the integrated conveyor logic without connecting the fieldbus controller to a higher-level PLC

- Auto configuration with ECShell
- Parameterization with ECShell
- Bus Master Integration

2. Startup with Bus Master

The integrated conveyor logic of the fieldbus controller is not used. The travel commands are issued only by the external control signal source.

- Bus Master Integration
- Parameterization in the Busmaster

6.1 Startup with ECShell

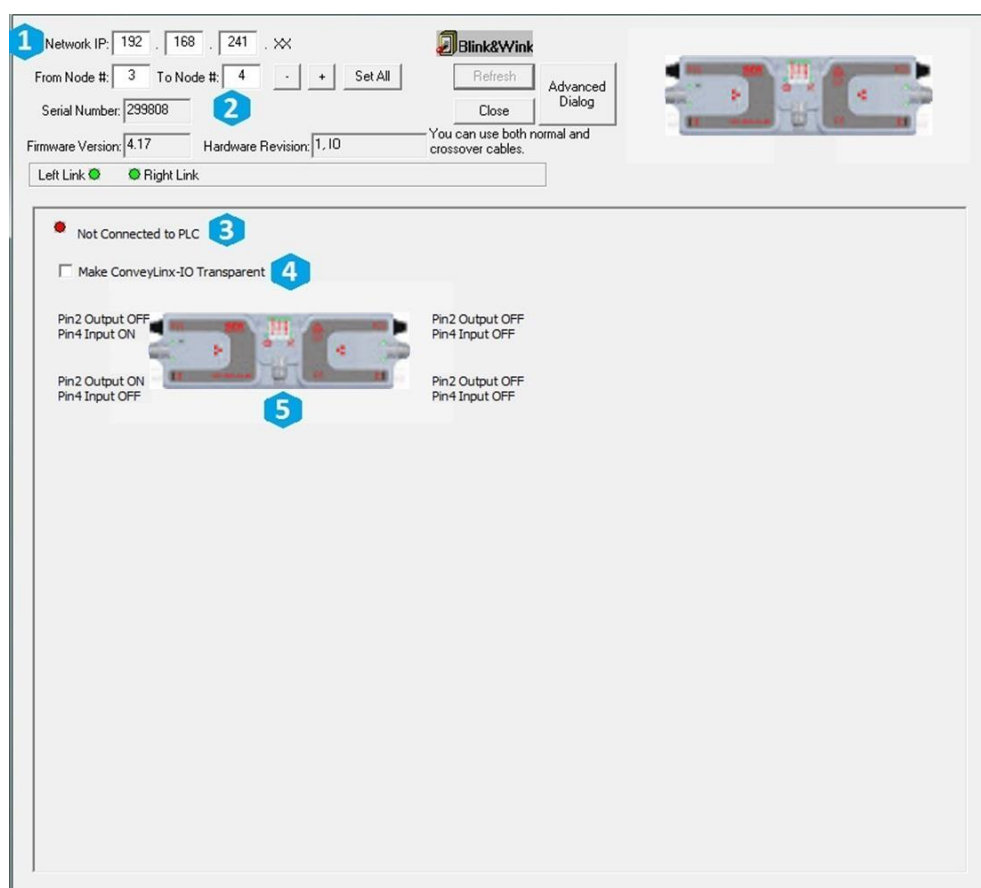
6.1.1 Auto configuration

Run the auto configuration process according Operating Instructions - ECDriveS® ECC-DFC Fieldbus Controller, chapter 7 and 8.

6.1.2 Configuration ECIO Module

ECShell main screen

Assuming you have either changed your PC's configuration or changed the Auto Configuration Master's configuration as described; you should now be able to use the ECShell main screen to view your system's status and change operational parameters. The main screen is also shown when you first run ECShell.



The numbered items in the Figure show the basic functional areas and detailed descriptions will follow for each:

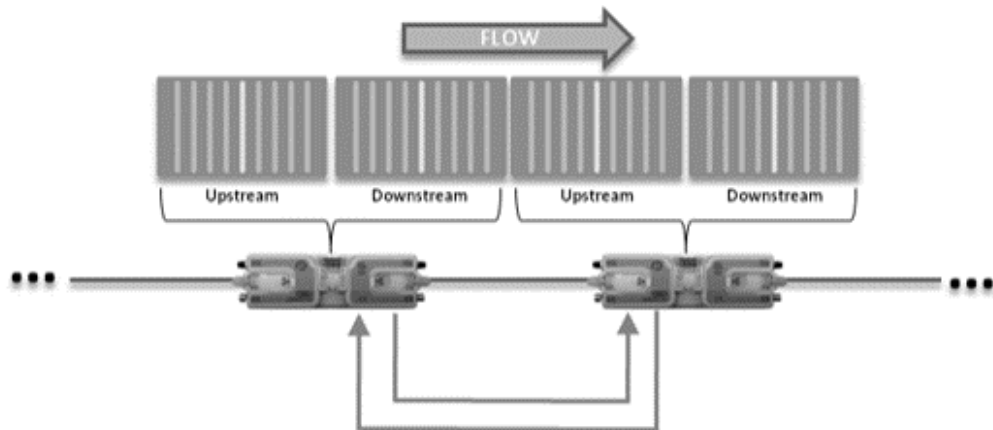
Item	Description
1	Network IP – This is where you enter the Subnet of the particular network you wish to connect
2	Node No. – This is where you enter a range of Nodes in which to connect. Entering values here will cause the “Refresh” button to enable. Clicking this button will cause the rest of the items (3, 4, and 5) to be populated.
3	ECIO Connection Status – This indicates whether a remote PLC is currently connected to the module.
4	ECIO Transparency – See section Transparency mode
5	Indicates the current on/off state of each digital input and output

Please note that some of the detailed information shown in this figure may be different for your particular system and that most of these fields will be blank until you actually initiate communications.

ECIO Transparency mode

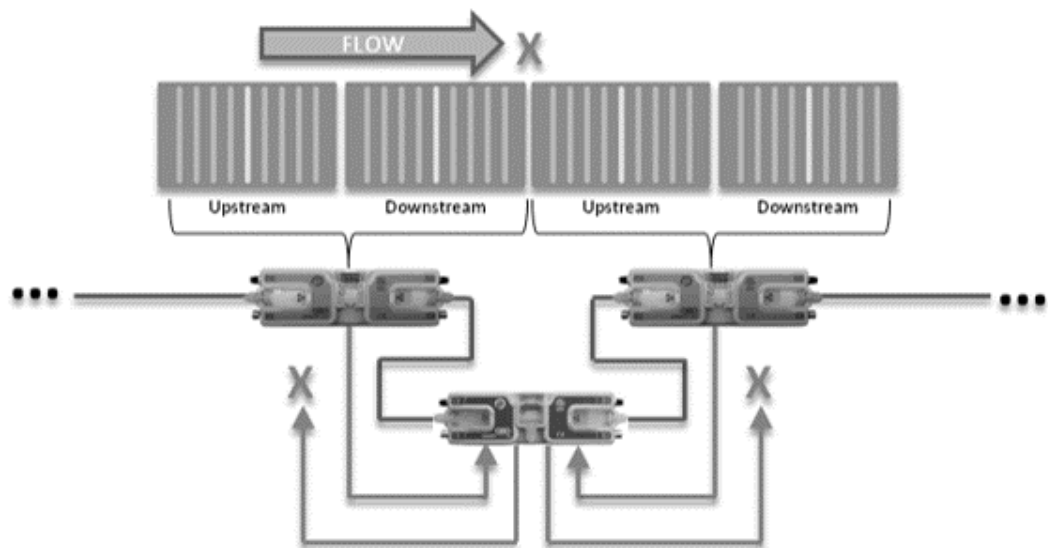
1. Typical ECDriveS® conveyor flow

ECDriveS® modules are most often used on motor roller conveyor applications where a network of modules is controlling zones of conveyor in a ZPA fashion. Part of the Auto-Configuration procedure establishes a “connection” between each module where each module receives status from its neighbors as to the status of each other’s zones. This is mechanism that provides the zone-to-zone flow of items on the conveyor.



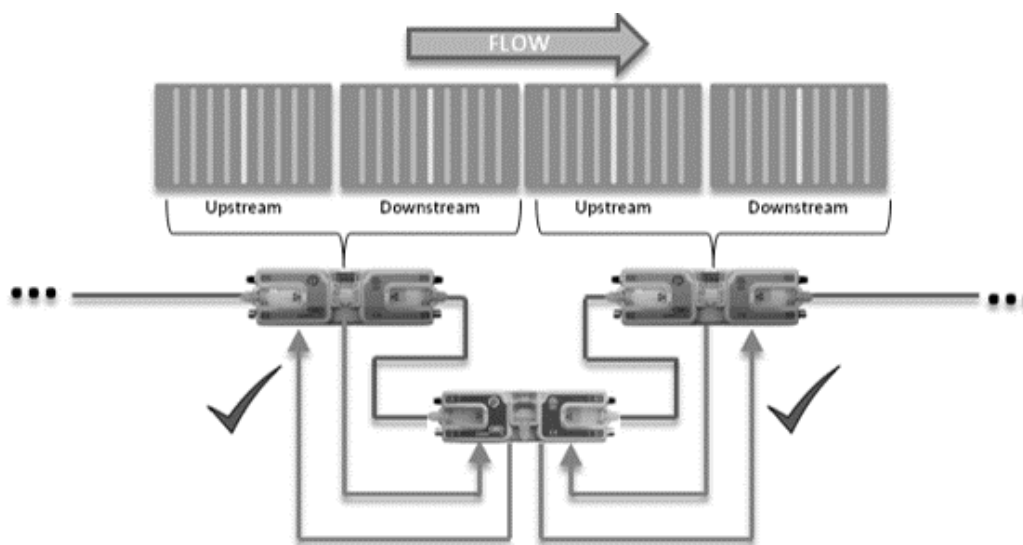
2. ECDriveS® conveyor system with ECIO configured in the system

When an application calls for additional digital I/O to be localized on such a conveyor network, it is convenient to install ECIO along the conveyor path. However, by default of the Auto-Configuration procedure, the ECIO gets configured along with its neighboring ZPA control ECC-DFC modules and is set up with these zone to zone flow connections. However, the zone to zone status data associated with these conveyor connections do not automatically pass through the ECIO module. The result is that conveyor flow will be interrupted.. This is illustrated in the Figure below.



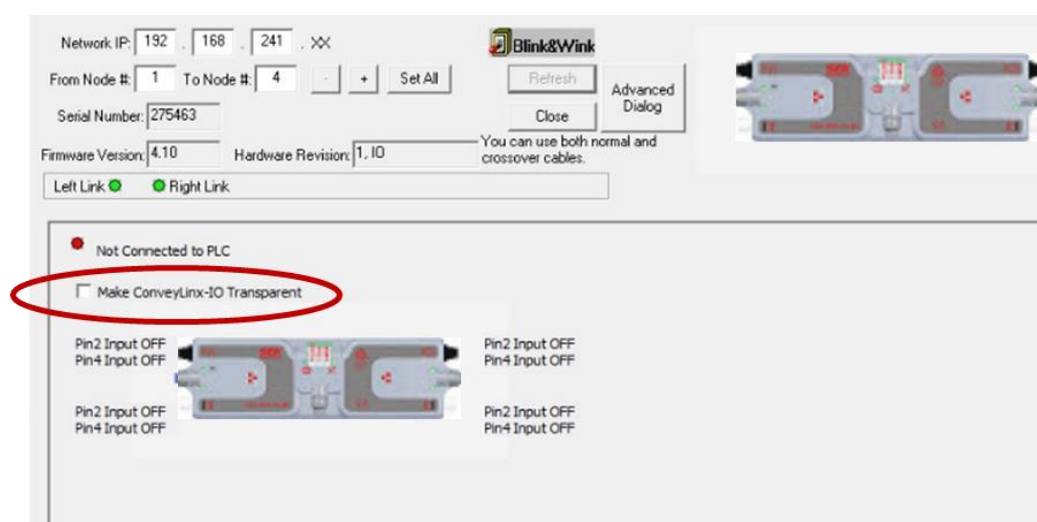
3. ECDriveS® conveyor system with ECIO configured in the system and activated transparency mode

In applications where an ECIO module is installed between two ECC-DFC modules that need to maintain their logical upstream to downstream flow; the Transparency Option instructs the ECIO module to automatically pass through the conveyor flow status data between its ECC-DFC neighbors. This in essence makes the ECIO “transparent” to the conveyor flow. The conveyor will operate as if the two ECC-DFC conveyor controllers are connected to each other as illustrated in the next Figure.



Activating and deactivating transparency mode

Transparency is enabled by default during Auto-Configuration. Disabling Transparency mode is done on the ECShell main screen by clicking the check box as shown



6.2 Startup with Bus master

ECIO is a device that requires a remote PLC controller to connect and transfer data to control its digital I/O points. This section describes the network architecture utilized for the module and provides the data mapping details to access I/O for the 3 main protocols that the module recognizes.

6.2.1 ECDriveS® network architecture

Each module communicates to its adjacent modules and to any connected PC or PLC via Ethernet physical media. ECDriveS® modules recognize 3 TCP/IP based protocols:

- Modbus TCP
- Profinet I/O
- EtherNet/IP

Modbus TCP is the “native” protocol for communications between the fieldbus modules and the ECShell PC software. When the modules create connections between them, they utilize Modbus TCP for inter-module communication.

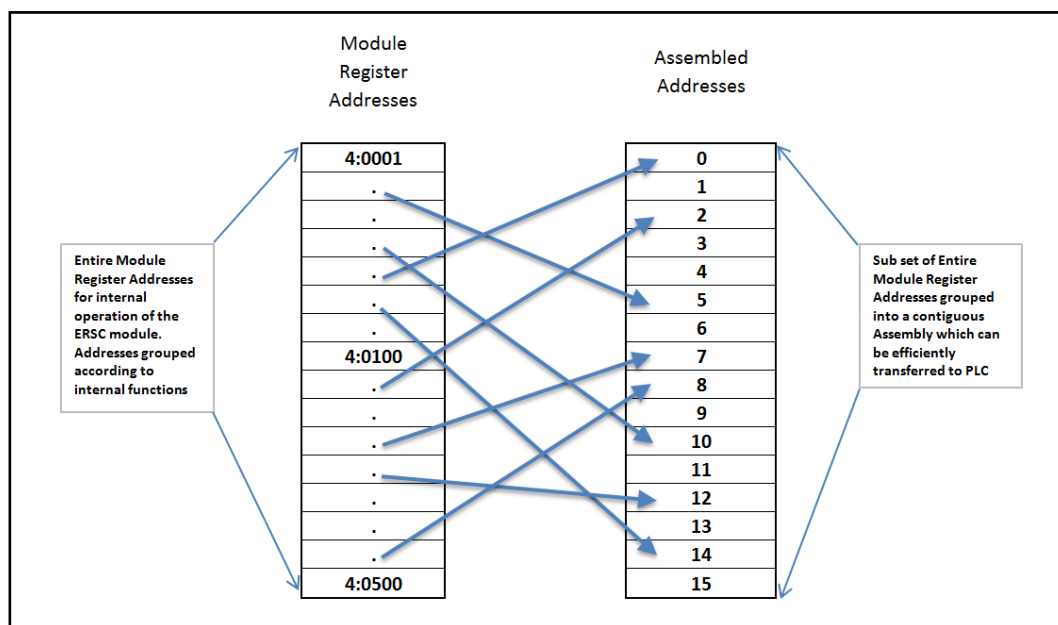
EtherNet/IP is recognized by the modules and any given module can be attached to an EtherNet/IP capable PLC (Allen-Bradley ControlLogix or CompactLogix platforms for example) and be recognized as a “Generic Ethernet Module” or explicitly as a module by using the provided EDS file.

Profinet I/O is recognized by the modules and can be attached to any Profinet I/O capable PLC (applicable Siemens platforms). All protocols access the same internal data locations on a given module.

Each ECIO module’s internal data structure is arranged and addressed as Modbus Holding registers. The on-board communication and control processes attach logical meanings to each holding register and read and write data to specific registers to initiate and/or react to events. Certain registers contain information as to how the module is configured (Inputs, Outputs, polarity etc.) for its local controls.

Understanding assemblies

The holding registers described above we will define as Module Register Addresses and are used for the function of the module regardless of if any remote PLC or PC is connected. There are many Module Register Addresses that are used for the operation of the module that are not applicable, required, or should even be made available to a remote PLC. When connecting to a PLC, the module needs to gather certain specific Module Register Addresses located scattered throughout the entire listing of Module Register Addresses into a concise contiguous group or Assembly that the PLC can efficiently read from and write to. The following Figure illustrates this concept:



So, no matter which of the three connection protocols you use (Modbus TCP, EIP, or Profinet I/O), for any given assembly, the internal data you are accessing with your PLC is the same

Modbus assembly instance structure

Each ECIO utilizes Modbus register architecture for remote data access over Ethernet. Modbus TCP is a simple protocol for data exchange based upon a query/response mechanism. Each module's memory structure contains a fixed array of internal data locations that are constructed as Modbus Holding Registers. Each module has a fixed reserve of Holding Registers with each capable of holding a 16-bit numerical integer value. Modbus TCP protocol provides for read/write access to any available Holding Register. The structure of these registers allows for individual module's to read from and write to specific register address locations to achieve inter-module communications. Certain registers are read from and written to by the ECShell software in order to monitor and/or change default configuration values.

Modbus TCP addressing convention utilizes a "4:xxxx" notation. The "4:" in Modbus protocol designates that the address is a Holding Register and the xxxx is a numerical value representing the offset or index for a specific location. The "xxxx" values used in this document are to be interpreted as if they are for a Modbus PLC which means that the first register address is "4:0001" and that there is no "4:0000" register. Some PLC data structures and PC development environments utilize the "4:0000" designation and their indexes will be offset by 1. Please refer to your PLC or PC application documentation for the Modbus convention used on their platforms.

Any Modbus TCP capable PC or PLC can connect to any ECIO module visible on its network and access Input and Output Holding Register Assemblies. ECIO supports the following Modbus TCP Service Codes:

Service Code 3 - Read Holding Register (up to 45 registers per instruction)

Service Code 6 - Write Single Register

Service Code 16 - Write Multiple Registers (up to 45 registers per instruction)

Service Code 23 - Read/Write Multiple Registers (up to 45 registers per instruction)

When using Input and Output Assemblies with Modbus TCP PLC, it is important to always use the first address shown in the assembly group as the beginning register to read or write regardless of which register in the assembly is needed by the PLC. Trying to access Input or Output Assemblies starting with any register in the assembly other than the first register will cause the module to return an error.

Ethernet I/P Assembly instance structure

When a ECIO module is attached to an external Ethernet I/P controller (Logix 5000 based PLC, for example), it is done so as a Generic Ethernet I/O device.

Part of this procedure in the PLC is to instruct the Generic device as to which data configuration or instance of Ethernet I/P the Generic device is to use to report and respond to data to and from the PLC.

These instances essentially group the appropriate Modbus registers into contiguous Input and Output array image that fit into the Allen-Bradley Logix 5000 controller tags.

Profinet IO Assembly instance structure

Prior to connecting any modules to a Profinet IO capable (Siemens, for example) PLC, a GSDXML configuration file needs to be installed in your PLC programming software (i.e. STEP 7 or TIA Portal). The GSDXML file contains, among other things, the definition of memory size required when connecting a module to a Siemens PLC with Profinet IO. When assigning an individual module to a PLC, you decide what memory address to use. The GSDXML file stipulates that each module requires 64 bytes of input data from the module to the PLC and 64 bytes of output data from the PLC to the module. When assigning an individual module to a PLC, you decide what physical PLC memory address to use as the beginning of these 64 byte blocks.

In all of the charts showing module data registers and their assigned function, for Profinet IO these are indicated as "Byte 0, Byte 1,...Byte 32", etc. These are offsets from the starting address in the Siemens PLC memory assigned by the Siemens programming software when the module was installed into the network. For example, if a module's inputs are installed beginning at %IB256, then from our charts, the data for "Byte 6 and Byte 7" would be at addresses %IB262 and %IB263 respectively.

6.2.2 Configuration Assembly

The configuration data is sent from the controller to the module upon initial connection in order to set optional module operational parameters.

REGISTER CHART LEGEND



This chart shows the data sent to the PLC from the module when connected. All registers in the module are 16-bit integer data type.

Register Name / Module Address	Assembled Address for PLC	Description
Input/Output 4:0497	M: 4:13800 E: C.Data[0]	Input/Output Configuration 1 = set Pin as Output 0 = set Pin as Input bit 0 : Left Male Pin2 bit 1 : Left Female Pin2 bit 2 : Right Male Pin2 bit 3 : Right Female Pin2 bit 4 : Left Male Pin4 bit 5 : Left Female Pin4 bit 6 : Right Male Pin4 bit 7 : Right Female Pin4 bit 8 to bit 15 - reserved
Input Polarity 4:0034	M: 4:13801 E: I.Data[1]	Inputs Polarity Configuration 0 = Input signal and logic states equal 1 = Invert logic from signal state bit 0 : Left Male Pin2 bit 1 : Left Female Pin2 bit 2 : Right Male Pin2 bit 3 : Right Female Pin2 bit 4 : Left Male Pin4 bit 5 : Left Female Pin4 bit 6 : Right Male Pin4 bit 7 : Right Female Pin4 bit 8 to bit 15 - reserved See Note ①
Output Polarity 4:0038	M: 4:13802 E: I.Data[2]	Outputs Polarity Configuration 0 = Output signal and logic states equal 1 = Invert logic from signal state bit 0 : Left Male Pin2 bit 1 : Left Female Pin2 bit 2 : Right Male Pin2 bit 3 : Right Female Pin2 bit 4 : Left Male Pin4 bit 5 : Left Female Pin4 bit 6 : Right Male Pin4 bit 7 : Right Female Pin4 bit 8 to bit 15 - reserved See

		Note ② Fehler! Verweisquelle konnte nicht gefunden werden.
PushPull 4:0496	M: 4:13803 E: I.Data[3]	Push/Pull Inputs Configuration 0 = Input circuit Not Push-Pull type 1 = Input circuit is Push-Pull type bit 0 : Left Male Pin2 bit 1 : Left Female Pin2 bit 2 : Right Male Pin2 bit 3 : Right Female Pin2 bit 4 : Left Male Pin4 bit 5 : Left Female Pin4 bit 6 : Right Male Pin4 bit 7 : Right Female Pin4 bit 8 to bit 15 - reserved See Note ③
State On Disconnect 4:0255	M: 4:13804 E: I.Data[4]	Output State on Disconnect Configuration 0 = Output Pin de-energizes upon communication loss with remote controller 1 = Output Pin remains in last state upon communication loss with remote controller bit 0 : Left Male Pin2 bit 1 : Left Female Pin2 bit 2 : Right Male Pin2 bit 3 : Right Female Pin2 bit 4 : Left Male Pin4 bit 5 : Left Female Pin4 bit 6 : Right Male Pin4 bit 7 : Right Female Pin4 bit 8 to bit 15 - reserved See Note ④

Note ①

This register is only used for Pins configured as Inputs in the Input/Output register. If a given Pin's corresponding bit is 0 in this register, the logical state of the Pin's data seen in the Inputs register of the Inputs Assembly will match the logical state of the electrical signal on the Pin. If a given Pin's corresponding bit is 1 in this register, the logical state of the Pin's data seen in the Inputs register of the Inputs Assembly will be inverted from the logical state of the electrical signal on the Pin.

This is provided as a convenience for the remote controller programmer. For example, the remote controller could have re-useable code or routines that expect a photo sensor to have its electrical signal ON when it is "blocked". Let's say on a given module, you need to connect a photo sensor whose electrical signal is OFF when "blocked". Instead

of modifying the program logic in each and every place this input is used; you can simply change its logical polarity with this register

Please note that this register also controls the state of the LED indicators for the given Pin. The LED state will match the logical state of the pin.

For example, by default when the Left Sensor input is electrically energized, its corresponding LED illuminates green and bit 4 of the Inputs register in the Inputs Assembly is a 1. If you set bit 4 in the Input Polarity register; when the Left Sensor input is electrically energized, bit 4 of the Inputs register is 0 and its corresponding LED is off.

Note ②

This register is only used for Pins configured as Outputs in the Input/Output register. If a given Pin's corresponding bit is 0 in this register when the remote controller sets the logical state of the Pin in the Outputs register in the Output Assembly, the electrical signal on the Pin will match this logical state. If a given Pin's corresponding bit is 1 in this register, the electrical signal on the Pin will be inverted from the logical state.

Note ③

This register is only used for Pins configured as Inputs.

Note ④

This register is only valid for Pins configured as Outputs

INFORMATION



Upon power-up, all I/O Pins default to being inputs. Because these input pins are NPN/PNP auto-sensing, there is a voltage (approx. 12V) on the circuit that will produce up to a 2 mA leakage current. When using a given Pin as an output, there may be a time delay between module boot-up and the remote controller configuring the Pin as an output. During this time delay, if you have a device connected to the Pin, it may receive the auto-detect circuit's voltage and leakage current.

6.2.3 ECIO Real time data

Input Assembly (ECIO ⇨ PLC)

Register Name / Module Address	Assembled Address for PLC	Description
Inputs 4:0035	M: 4:13500 E: I.Data[0]	Bitwise Value - Read only bit 00 = Left Male Pin 2 bit 01 = Left Female Pin 2 bit 02 = Right Male Pin 2 bit 03 = Right Female Pin 2 bit 04 = Left Male Pin 4 bit 05 = Left Female Pin 4 bit 06 = Right Male Pin 4 bit 07 = Right Female Pin 4 bit 08 = Error Left Male Pin 2 bit 09 = Error Left Female Pin 2 bit 10 = Error Right Male Pin 2 bit 11 = Error Right Female Pin 2 bit 12 = Error Left Male Pin 4 bit 13 = Error Left Female Pin 4 bit 14 = Error Right Male Pin 4 bit 15 = Error Right Female Pin 4 See Note ⑤

Note ⑤

Bits 8 through 15 indicate error conditions for each port pin when they are configured as outputs. If any of these bits are set, it indicates that there is an over-current or short circuit detected on its respective port's power supply.

Output Assembly (PLC ⇒ ECIO)

Register Name / Module Address	Assembled Address for PLC	Description
Outputs 4:0037	M: 4:13600 E: O.Data[0]	Set bit to energize Output bit 0 : Left Male Pin2 bit 1 : Left Female Pin2 bit 2 : Right Male Pin2 bit 3 : Right Female Pin2 bit 4 : Left Male Pin4 bit 5 : Left Female Pin4 bit 6 : Right Male Pin4 bit 7 : Right Female Pin4 bit 8 to bit 15 - reserved These bits are only recognized for a given port pin if it has been configured as an Output

7 Operation

7.1 Status LED

Several LED's indicate ECIO module status. All LED's with the exception of the Ethernet Link and Activity LEDs are multi-coloured and context sensitive. The following chart indicates the various meanings of all ECIO LED indicators. Please refer to chapter 3.2 for the item number locations on the module. By definition, Blinking is approximately ½ second on/off cycle and Flashing is approximately ¼ second on/off cycle.

Communications

Indicator	Item	LED State	Description
Ethernet Left Link & Ethernet Right Link	On the RJ-45 connectors (5, 9)	OFF	No connection established
		Solid Green	Connection is established
		Blinking Green	When data transmission activity is occurring

Network & Module Function

Indicator	Item	LED State	Description
Module Status	8	Blinking Red	ECIO is starting task processes
		Blinking Green	ECIO is ready
		Flashing Green & Blinking Red	Failsafe Mode
		Flashing Red	Auto Configure Mode is active
		Blinking Amber	Connection to peer lost or performing firmware upgrade check
		Solid Amber	Firmware upgrade in progress

Inputs

Indicator	Item	LED State	Description
Left & Right IO LEDs	3, 10, 14, 16	OFF	Inputs are OFF
		Solid Green	Input pin4 is ON
		Solid Red	Input pin2 is ON

Outputs

Indicator	Item	LED State	Description
Left & Right IO LEDs	3, 10, 14, 16	OFF	Outputs are OFF
		Flash Green	Output pin4 is ON
		Flash Red	Output pin2 is ON

Power

Indicator	Item	LED State	Description
Power	7	Solid Blue	Power supply is connected and voltage is within acceptable range
		Slow Blink Blue	Outputs power is under 18V

8 Waste disposal

Observe the applicable national regulations.

Dispose of materials separately in accordance with the regulations in force, for example:

- Electronics scrap (printed circuit boards)
- Plastic
- Sheet metal
- Copper
- Aluminum

9 Technical data

9.1 Basic Device

The following tables list the technical data for the device:

9.1.1 General

General	
Power supply Voltage	24 V +/- 10 %
Standby current consumption	less than 70mA
Minimum Operating Voltage	21 V
Maximum Operating Voltage	30 V
Storage temperature	-40 °C to 120 °C
Ambient Operating temperature	0 °C to 50 °C
Humidity	5 % to 95 % non-condensing
Vibration	0.152 mm displacement, 1G peak
Mechanical Shock	20G peak for 10ms duration (1.0 ms)
Enclosure IP Rating	IP54
Maximum current (for 8 outputs)	2.4 A

9.1.2 Inputs

Inputs	PNP/NPN Auto-sensing (Default) Up to 8 per module - 2 inputs per port Programmable Push-Pull selectable
Minimum ON current	1.5 mA
Maximum OFF current	0.4 mA
Short Circuit protection(per side)	500mA max

Sensor port inputs are auto-sensing for the connected circuit type of either PNP or NPN. Please note that both sourcing and sinking current will activate the input.

Each port utilizes load detection circuits between the +24V (Pin 1) and Gnd (Pin 3). This circuit provides input to the processor to detect if a power consuming device is connected. Short circuit between Pin 1 and Pin 3 can cause damage to the load detection circuit and render this function inoperable.

9.1.3 Outputs

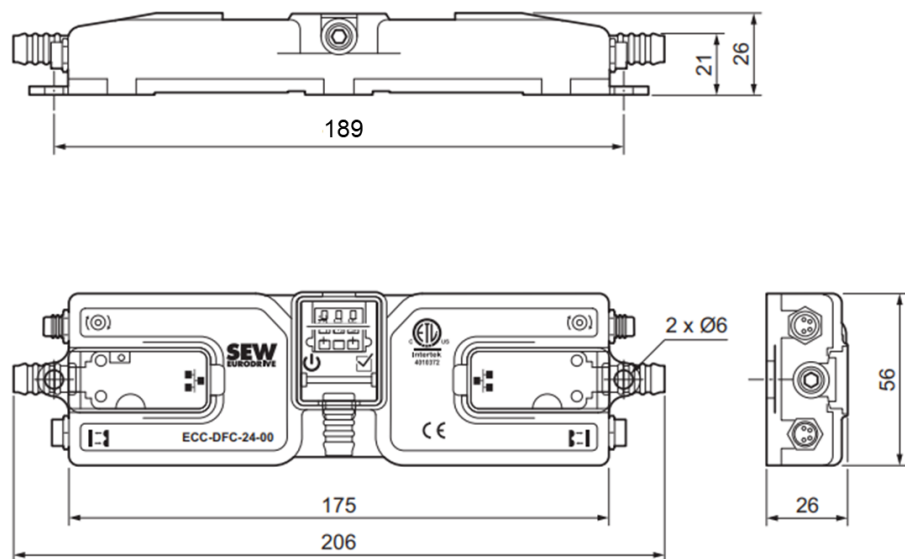
Outputs	PNP only
Output count	Up to 8 per module
Maximum current (per Output)	300 mA
Short-circuit protection threshold(per Output)	500 mA

9.1.4 Ethernet Specification

- 3 port integrated switch (2 external ports and 1 port for the on-board processor)
- Automatic speed setup (10Base-T / 100Base-TX)
- Automatic duplex configuration (Full / Half)
- Automatic straight/crossover cable detection (Auto MDI/MDI-X)
- PAUSE frame support
- Back pressure flow control support
- Maximum segment length: 100m / 328ft
- Supported network protocols
 - Modbus/TCP
 - EtherNet/IP
 - Profinet I/O

9.2 Dimension drawing

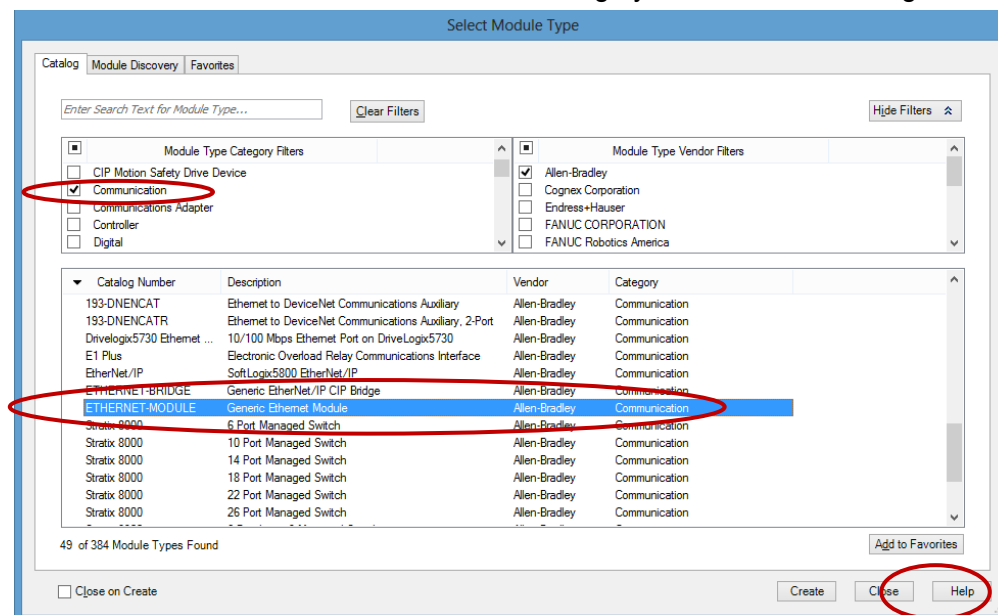
The dimension drawing shows the mechanical dimensions of the device in mm:



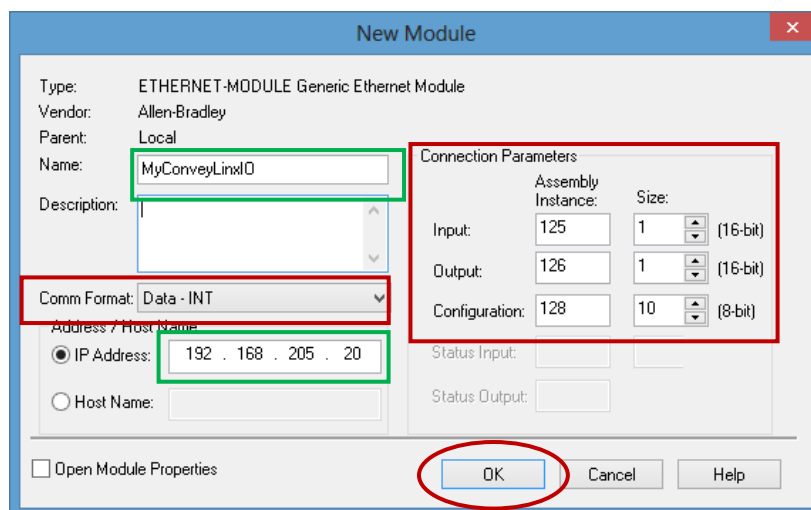
9007218771165963

10 Appendix A – Connecting to Rockwell Ethernet I/P PLC

In RSLogix-5000, when you add a new module in your Ethernet tree, you select “Generic Ethernet Module” from the “Communication” category as shown in below Figure:



When you click “Create”, you get the New Module Configuration Screen as shown below. Please note that the Name and IP address are for example only. The Comm Format and Connection Parameters must be entered as shown.



Once you have created and configured the new module, you can see the data tags created your Controller Tags view as shown below.

For example, if you populate bits 0 thru 3 in C.Data[0] with a “1”; by referencing the chart in section **Fehler! Verweisquelle konnte nicht gefunden werden.** on page **Fehler! Textmarke nicht definiert.**, this data configures Pin 2 on each Port to be a digital output.

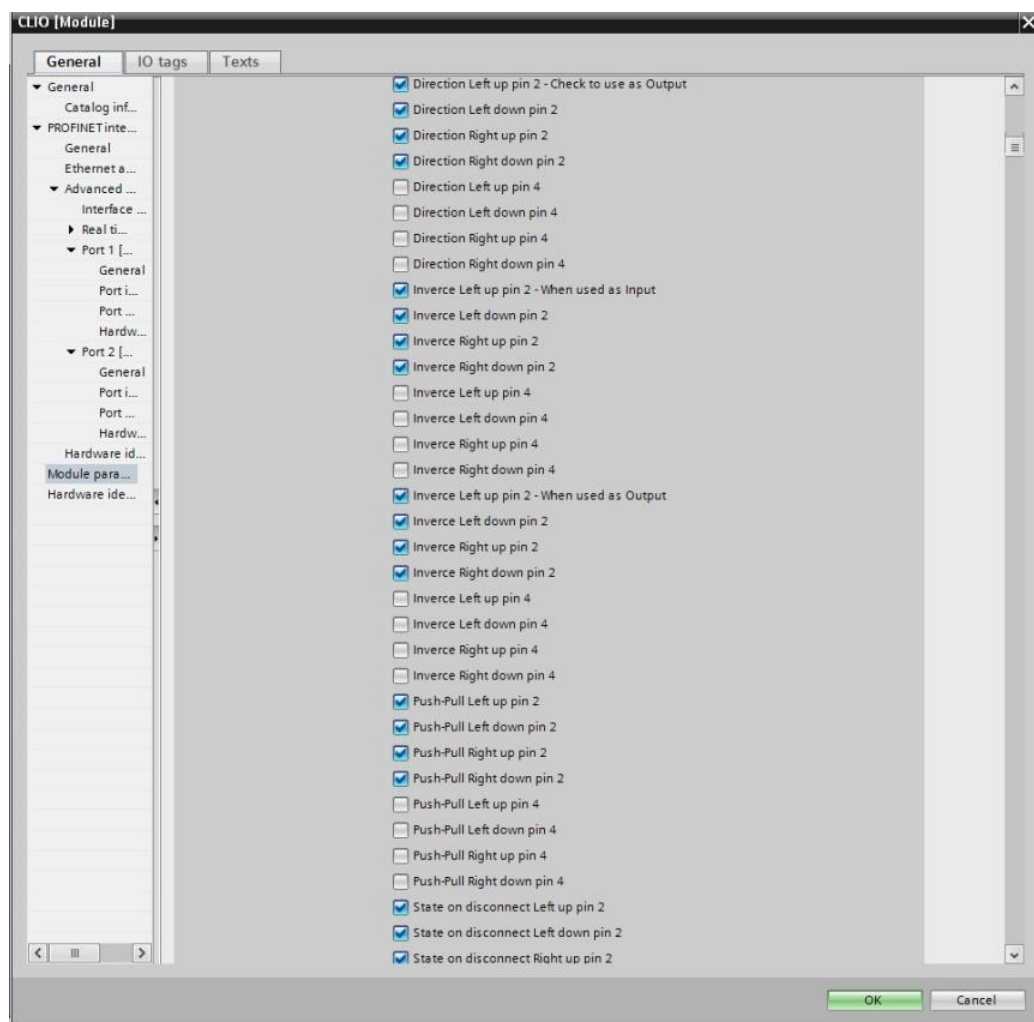
Name	Value	Force Mask	Style	Data Type
IO1:C	{...}	{...}		_055C:IO_CDCE...
IO1:C.Data	{...}	{...}	Decimal	SINT[10]
IO1:C.Data[0]	16#0f		Hex	SINT
IO1:C.Data[0].0	1		Decimal	BOOL
IO1:C.Data[0].1	1		Decimal	BOOL
IO1:C.Data[0].2	1		Decimal	BOOL
IO1:C.Data[0].3	1		Decimal	BOOL
IO1:C.Data[0].4	0		Decimal	BOOL
IO1:C.Data[0].5	0		Decimal	BOOL
IO1:C.Data[0].6	0		Decimal	BOOL
IO1:C.Data[0].7	0		Decimal	BOOL
IO1:C.Data[1]	0		Decimal	SINT
IO1:C.Data[2]	16#00		Hex	SINT
IO1:C.Data[3]	16#00		Hex	SINT
IO1:C.Data[4]	16#00		Hex	SINT
IO1:C.Data[5]	16#00		Hex	SINT
IO1:C.Data[6]	16#00		Hex	SINT
IO1:C.Data[7]	16#00		Hex	SINT
IO1:C.Data[8]	16#00		Hex	SINT
IO1:C.Data[9]	16#00		Hex	SINT
IO1:I	{...}	{...}		_055C:IO_F0B37...
IO1:O	{...}	{...}		_055C:IO_F5E3C...

Please note that RSLogix 5000, by default, creates an array tag of “SINT[400]” for the Configuration Assembly for any Generic Ethernet Module. When the program is actually downloaded to the PLC processor and begins communications with ECIO; the data exchanged will be the quantity of bytes entered when the module was created. For ECIO this is Configuration Assembly Instance 128 with a size of 10 bytes as shown in the figure New Module Configuration Screen.

11 Appendix B – Connecting to Siemens Profinet-IO PLC

ECIO supports PROFINET I/O and can be used as a remote I/O module to any Siemens Profinet I/O capable PLC. ECIO only exchanges 2 input bytes and 2 output bytes with the PLC so it uses very little of the PLC's available I/O memory.

Once you have the appropriate GDSXML file installed into your TIA Portal programming environment, ECIO will support Topological discovery and Media redundancy. The configuration parameters (i.e. the equivalent parameters shown in the chart in section **Fehler! Verweisquelle konnte nicht gefunden werden.**) can be found in the "Properties" of the device under "Module parameters" tab. The configuration data bits have been segmented into simple Boolean check box selections as shown below in below Figure.





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Driving the world

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