Advantys FTM CANopen IP67 Modular I/O Splitter box User guide

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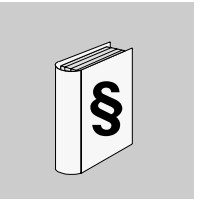
Safety Information



Important Information

NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a Danger or Warning safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates an imminently hazardous situation, which, if not avoided, **will result** in death or serious injury.

⚠ WARNING

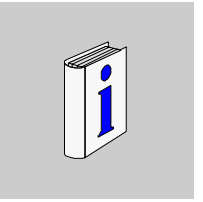
WARNING indicates a potentially hazardous situation, which, if not avoided, **can result** in death, serious injury, or equipment damage.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation, which, if not avoided, **can result** in injury or equipment damage.

PLEASE NOTE Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

About the Book



At a Glance

Document Scope

This user guide contains the information required to install an Advantys FTM CANopen modular IP67 splitter box.

It enables rapid familiarization with the system and its features, using a set of very advanced applications.

To install Advantys FTM CANopen splitter boxes, the relevant communication protocol pre-requisites are necessary, and it should only be installed by qualified personnel. Special points and warnings regarding safety are highlighted in the different chapters.

The early chapters provide information for designers and installers on installing the mechanical and electrical elements of the system.

The following chapters, from the section on "CANopen network interface", are specific to the communications protocol. They contain information on specific wiring for the network interface and all the necessary information for the software application programmer, and for the end user (diagnostics).

Chapter	Subject covered
Introduction	General presentation of system components
Installation	Dimensions Safe practice for installation
Module characteristics and wiring	Physical and electrical characteristics Wiring information
I/O splitter box characteristics and wiring	Physical and electrical characteristics Wiring information
CANopen network interface	Wiring the splitter box on the network Reminders regarding the communication protocol System behavior
Application functions	Description of application functions (I/O functions)
Software implementation	Software installation help
Diagnostics	Performing diagnostics
Object dictionary	Description of the objects accessible for communication
Appendices	At a Glance Appendix A: List of COB-IDs Appendix B: List of IEC symbols
Glossary	Acronyms Definitions

Related Documents

Title of Documentation	Reference Number
Instruction sheet for the FTM 1CN10 coupling device	1693683
Instruction sheet for the FTM1D• / FTM 1A• splitter box	1693687
CANopen hardware installation manual	35010859

User Comments

We welcome your comments about this document. You can reach us by e-mail at techpub@schneider-electric.com

Introduction

1

At a Glance

Introduction

This chapter provides a general overview of the Advantys FTM CANopen range of IP67 modular I/O splitter boxes.

Note: The information in this manual is primarily destined for those having some practical knowledge of the CAN standard applied to the CANopen field bus. CANopen equipment installers and users are advised to read the standard documentation before installing or handling any equipment All detailed standard specifications may be found at http://www.can-cia.de.

What's in this Chapter?

This chapter contains the following topics:

System Architecture

At a Glance

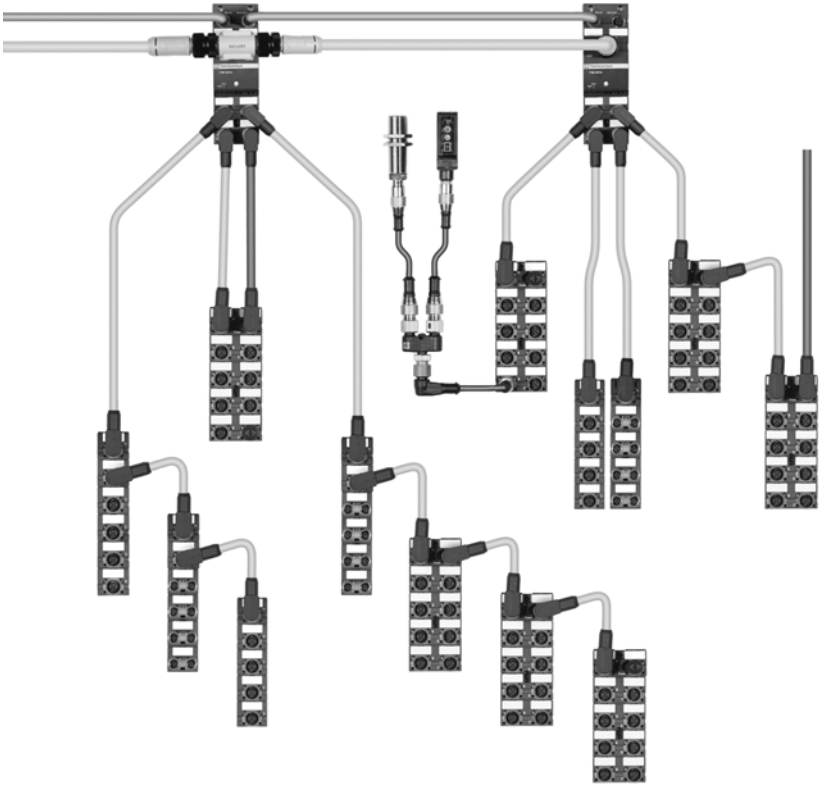
The Advantys FTM modular system enables you to connect a variable number of input/output splitter boxes, using a single communication interface (field bus module).

These splitter boxes are connected to the module using a hybrid cable which includes the internal bus and power supply (internal, sensor and actuator).

The input/output splitter boxes are independent of the field bus type, thus reducing the number of splitter box references. Once installed, the system is ready to begin operation.

Network Topology

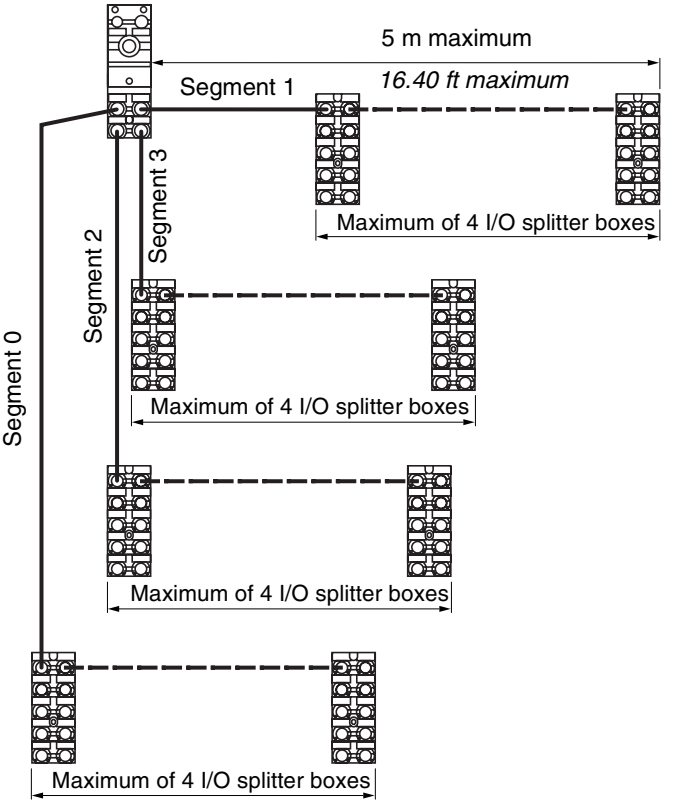
The system topology is a star/line architecture.



Each module is fitted with 4 M12-type connectors for connecting the Advantys FTM splitter boxes (star architecture).

Segment Structure

For each communication or node coupling device, up to 4 I/O splitter boxes may be connected in a daisy chain arrangement (line architecture):



⚠ WARNING

RISK OF UNINTENDED EQUIPMENT OPERATION

A segment length must not exceed 5 m *(16.4 ft)*. Failure to observe this length restriction may cause the internal bus to malfunction.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Maximum Discrete I/O Capacity

The system configuration and the number of I/O splitter boxes connected to the module depend on the type of splitter boxes used.

For a given connecting device, the maximum number of Discrete I/O splitter boxes is:

- 4 per segment, or 64 I/O.
- 16 for all of the 4 possible segments of the I/O splitter box module, or 256 Discrete I/O.

Maximum Configuration

The system configuration and the number of splitter boxes connected to the connecting device depend on the type of splitter boxes used.

The maximum configuration by splitter box type is defined in the following table:

Number of analog splitter boxes	Number of Discrete splitter boxes
4	4
3	8
2	12
1	15
0	16

Overview of the Product Range

Different Types of Splitter Boxes

Different types of Advantys FTM splitter boxes are available:
- Discrete I/O splitter boxes:
  - Compact
  - Extendable
- Analog I/O splitter boxes:
  - Compact.

Discrete I/O Splitter Boxes

These splitter boxes are available in compact or extendable versions.

Their properties are as follows:
- 24 VDC, IEC type 2 inputs,
- 24 VDC, 0.5 A transistor outputs.

Input splitter boxes

These are only used for connecting sensors.

The different types of input splitter boxes are as follows:
- 8 M8-type connector splitter boxes, for connecting up to 8 sensors.
- 4 M12-type connectors allow you to connect up to 8 sensors (4 in the case of sensors fitted with a diagnostics function).
- 8 M12-type connectors allow you to connect up to 16 sensors (8 in the case of sensors fitted with a diagnostics function).

Configurable Input/output splitter boxes

These are used for connecting sensors and/or actuators.

The different types of input/output splitter boxes are as follows:
- 8 M8-type connector splitter boxes, for connecting up to 8 sensors or actuators.
- 4 M12-type connectors allow you to connect up to 8 sensors or actuators (4 in the case of sensors or actuators fitted with a diagnostics function).
- 8 M12-type connectors allow you to connect up to 16 sensors or actuators (8 in the case of sensors or actuators fitted with a diagnostics function).

Note: Each channel can be configured as an input or output, or as a diagnostics input (pin 2). Standard diagnostics channels conform to the DESINA standard.

Analog I/O Splitter Boxes

These splitter boxes are only available in compact version.

They are used to connect analog sensors or actuators to an M12-type connector:

- 4-input analog splitter boxes (voltage or current),
- Analog 4-output splitter boxes (voltage or current).

Compact Splitter Boxes

A compact splitter box does not allow continuity from the internal bus to other splitter boxes on the same segment.

They are used in the following cases:

- 1 single splitter box on a segment (no daisy-chaining),
- Final splitter box on a segment.

Extendable Splitter Boxes

A splitter box allows continuity from the internal bus to other splitter boxes (daisy-chaining).

⚠ WARNING

RISK OF MALFUNCTION

If an extendable splitter box is used as the final splitter box for an internal bus segment, install a line terminator on the output bus connector.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

⚠ WARNING

RISK OF NON-COMPLIANCE WITH IP67

For IP67 protection:

- properly fit all connectors with cables or sealing plugs and tighten,
- install cover onto coupling device and tighten captive screws to specified torque.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Splitter Box References

The references for discrete splitter boxes are listed in the following table:

Reference	Connector	Discrete input	Discrete Output	Compact	Extendable	Configurable
FTM 1DD08C08	8 M8	0...8	0...8	x	-	x
FTM 1DD08C12	4 M12	0...8	0...8	x	-	x
FTM 1DD16C12	8 M12	0...16	0...16	x	-	x
FTM 1DD08C08E	8 M8	0...8	0...8	-	x	x
FTM 1DD08C12E	4 M12	0...8	0...8	-	x	x
FTM 1DD16C12E	8 M12	0...16	0...16	-	x	x
FTM 1DE08C08	8 M8	8	-	x	-	-
FTM 1DE08C12	4 M12	8	-	x	-	-
FTM 1DE16C12	8 M12	16	-	x	-	-
FTM 1DE08C08E	8 M8	8	-	-	x	-
FTM 1DE08C12E	4 M12	8	-	-	x	-
FTM 1DE16C12E	8 M12	16	-	-	x	-

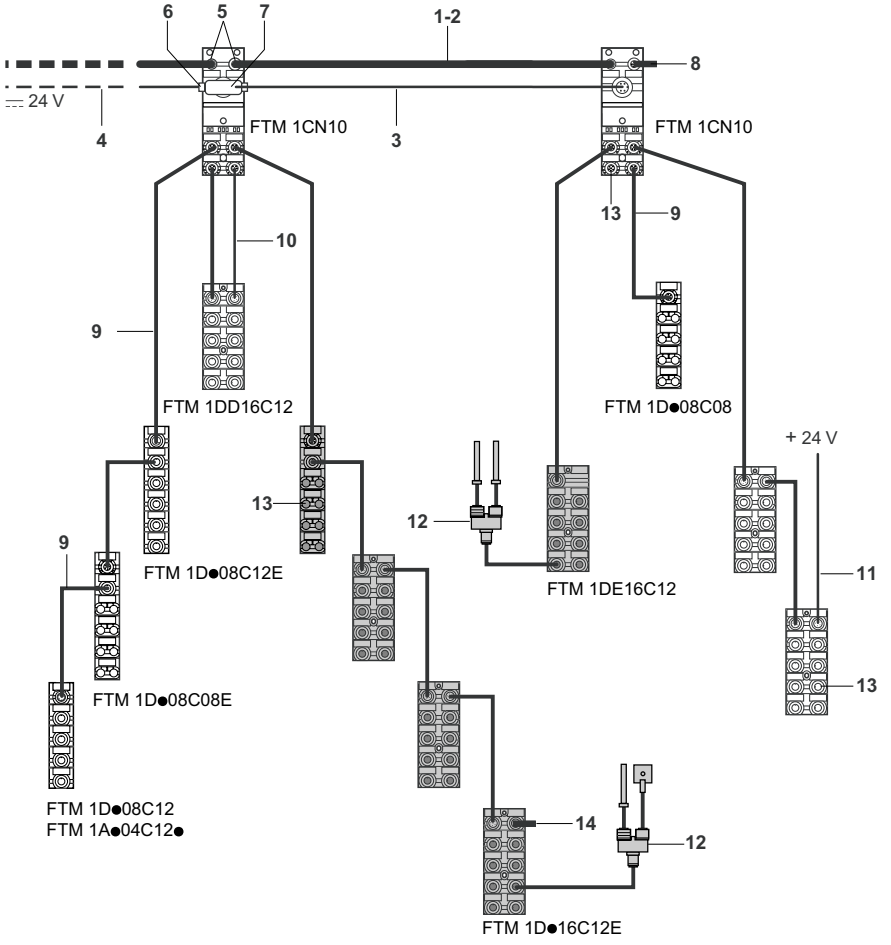
The references for analog splitter boxes are listed in the following table:

Reference	Connector	Analog Input		Analog output		Compact	Extendable
		Voltage	Current	Voltage	Current		
FTM 1AE04C12C	4 M12	-	4	-	-	x	-
FTM 1AE04C12T	4 M12	4	-	-	-	x	-
FTM 1AS04C12C	4 M12	-	-	-	4	x	-
FTM 1AS04C12T	4 M12	-	-	4	-	x	-

Presentation of the Accessories Range

Connection Cables from the Bus to the Module

Different cables can be used to connect the module to the field bus. These are available in different lengths.



Element	Reference	Function
1	FTX CN3203 FTX CN3206 FTX CN3210 FTX CN3220 FTX CN3230 FTX CN3250	Cables fitted with 2 M12-type 5 pin elbow connectors, with two ends for connecting the bus to two coupling devices. Available lengths: 0.3 m, 0.6 m, 1 m, 2 m, 3 m and 5 m *(0.98 ft, 1.97 ft, 3.28 ft, 6.56 ft, 9.84 ft, 16.4 ft)*.
2	FTX DP2206 FTX DP2210 FTX DP2220 FTX DP2250	Cables fitted with 2 7/8 type 5 pin connectors, with two ends for daisy-chaining 24 VDC supplies to two coupling devices. Available lengths: 0.6 m, 1 m, 2 m and 5 m *(1.97 ft, 3.28 ft, 6.56 ft, 16.4 ft)*.
3	FTX DP2115 FTX DP2130 FTX DP2150	Cables fitted with 1 7/8-type 5 pin connector, with one free end and the other for connecting 24 VDC supplies. Available lengths: 1.5 m, 3 m and 5 m *(4.92 ft, 9.84 ft, 16.4 ft)*.
4	FTX CN12M5	Male M12-type 5 pin connectors, for CANopen bus cables (encoding A).
	FTX CN12F5	Female M12,-type 5 pin connectors, for CANopen bus cables (encoding A).
5	FTX C78M5	Male and female 7/8-type 5 pin connectors, for 24 VDC supply cables.
	FTX C78F5	Female 7/8-type 5 pin connectors, for 24 VDC supply cables.
6	FTX CNCT1	T-connector fitted with 2 7/8-type 5 pin connectors, for supply cables.
7	FTX CNTL12	Line terminators fitted with 1 M12-type connector.
8	FTX CB3203 FTX CB3206 FTX CB3210 FTX CB3220 FTX CB3230 FTX CB3250	Cables fitted with 2 M12-type 6 pin elbow connectors,, with two ends for connecting the internal bus to the module and splitter box, or for daisy-chaining two splitter boxes. Available lengths: 0.3 m, 0.6 m, 1 m, 2 m, 3 m and 5 m *(0.98 ft, 1.97 ft, 3.28 ft, 6.56 ft, 9.84 ft, 16.4 ft)*.
9	FTX CA3203 FTX CA3206 FTX CA3210 FTX CA3220 FTX CA3230 FTX CA3250	Cables fitted with 2 M12-type 6 pin connectors, with two ends for connecting 24 VDC supplies to the module and splitter box. Available lengths: 0.3 m, 0.6 m, 1 m, 2 m, 3 m and 5 m *(0.98 ft, 1.97 ft, 3.28 ft, 6.56 ft, 9.84 ft, 16.4 ft)*.
10	FTX CA3103 FTX CA3106 FTX CA3110 FTX CA3120 FTX CA3130 FTX CA3150	Cables fitted with 1 M12-type 6 pin elbow connector, with one free end for connecting 24 VDC supplies. Available lengths: 0.3 m, 0.6 m, 1 m, 2 m, 3 m and 5 m *(0.98 ft, 1.97 ft, 3.28 ft, 6.56 ft, 9.84 ft, 16.4 ft)*.

Element	Reference	Function
11	FTX CY1208	Y-connector for connecting 2 M8-type connectors to the M12 connector of the splitter box.
	FTX CY1212	Y-connector for connecting 2 M12-type connectors to the M12 connector of the splitter box.
12	FTX CM08B	Sealing plugs for M8-type connectors (splitter boxes).
	FTX CM12B	Sealing plugs for M12-type connectors (coupling devices and splitter boxes).
13	FTX CBTL12	Line terminator of the internal bus fitted with 1 M12-type connector.

Use of the Diagnostics Function of Pin 2

Diagnostics Function

Advantys FTM splitter boxes enable the use of sensors and actuators fitted with a built-in diagnostics function (conforming to the DESINA standard).

When configured as a diagnostics input, the pin 2 of each M12-type connector can be used to detect external splitter box faults relating to sensors or actuators.

Types of Faults

This information is used to detect the following faults:

- Damage to the detection surface
- Inoperative electronics
- No load

Choice of Diagnostics Input

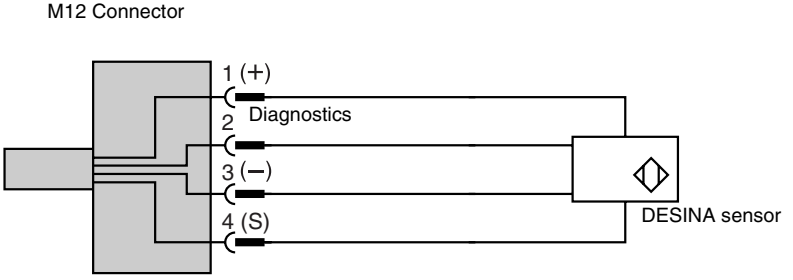
The choice between the sensor input function or diagnostics input function at pin 2 level is made for each channel and each setting, when configuring the splitter box.

Fault Display

Faults can be displayed by a red LED on each channel configured as a diagnostics input.

Example 1

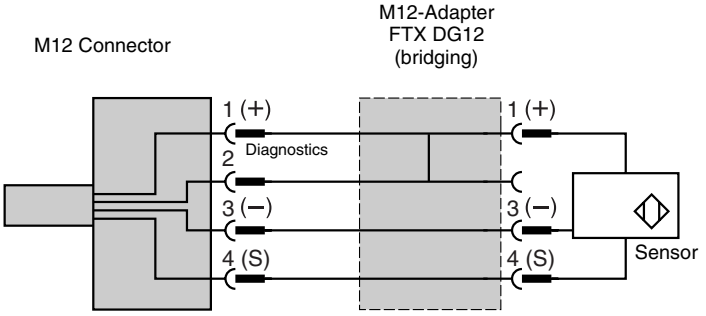
Connecting a sensor fitted with a diagnostics function:



Example 2

Using an FTX DG12 accessory, an M12-type diagnostics adaptor, it is possible to monitor breakages in cables leading to sensors or actuators not fitted with a built-in diagnostics function (only for splitter boxes fitted with M12-type connectors).

Connection of a standard sensor with diagnostics adapter:



Installation

2

At a Glance

Introduction

This chapter will take you through the stages involved in installing an FTM coupling device on a field bus, in compliance with the safety guidelines.

Note: The graphic representations of the coupling devices and splitter boxes in this chapter may not correspond to those really used. However, the dimensions are exact in any case.

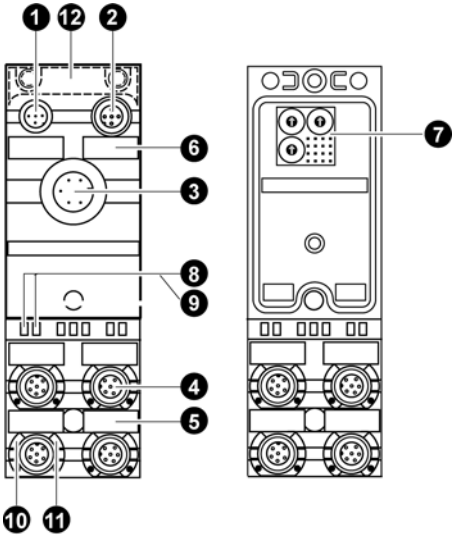
What's in this Chapter?

This chapter contains the following topics:

Overview

Module Description

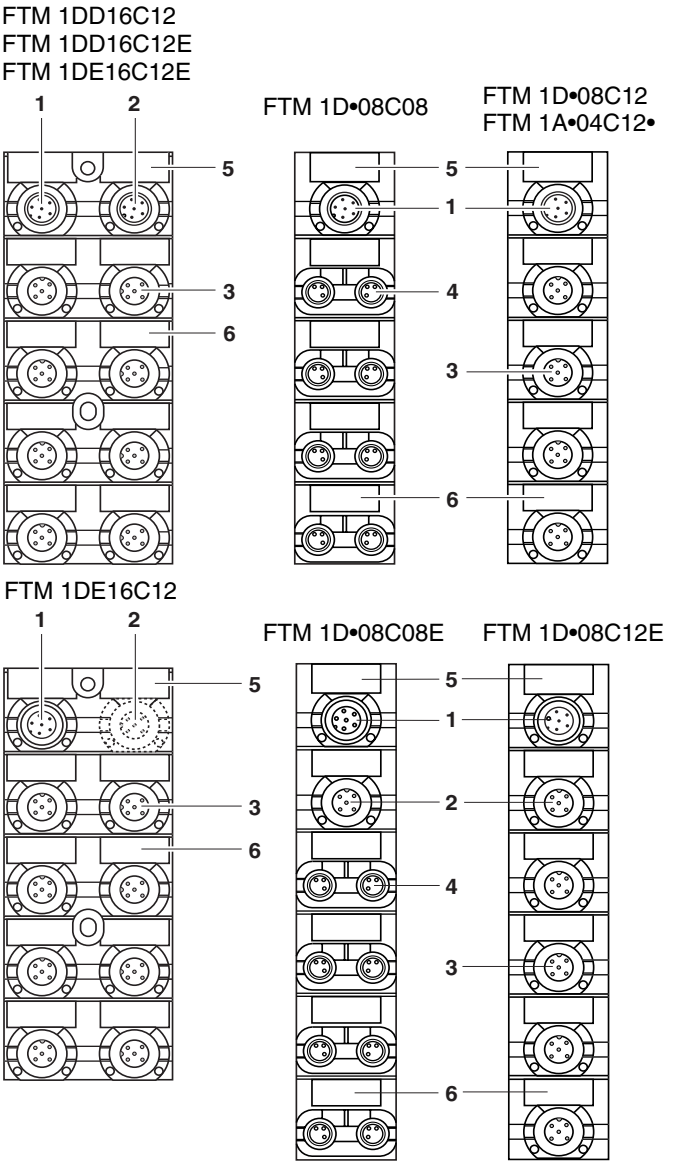
This is the front view of a coupling device (a coupling device closed on the left, open on the right):



Element	Function
1	An M12-type (bus IN) male connector for bus connection.
2	An M12-type (bus OUT) female connector for bus connection.
3	A 7/8-type male connector for connecting the 24 VDC power supplies.
4	Four M12-type female connectors for connecting the I/O splitter boxes via the internal bus.
5	Four segment identification labels.
6	Two module identification labels.
7	Bus address and speed selection switches.
8 and 9	Bus diagnostics LED
10	Sensor supply diagnostics LED.
11	Actuator supply diagnostics and communication status LED.
12	Module functional ground connection.

Splitter box Description

Front view of a splitter box:



Element	Function
1	An M12-type male connector for connection to the coupling device or previous splitter box.
2	An M12-type female connector for daisy-chaining the internal bus to the next splitter box.
3	Four or eight M12-type female connectors (depending on model) for connecting sensors and actuators.
4	Eight M8-type female connectors for connecting sensors and actuators.
5	One or two splitter box identification labels (depending on model).
6	Four or eight channel identification labels.

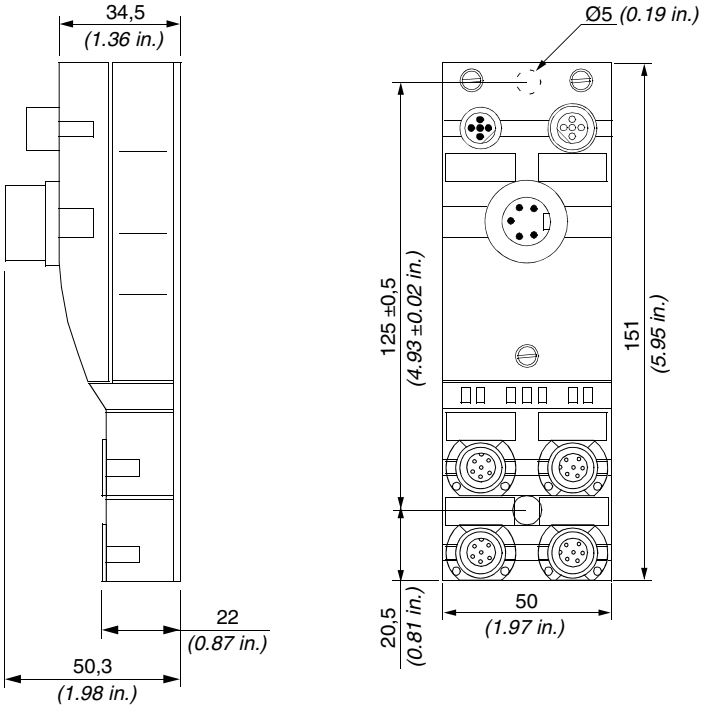
Installing the Coupling Device

Types of Screws and Tightening Torques

Coupling devices are mounted using two 4 mm *(0.15 in.)* diameter screws and two washers. The tightening torque is 2 Nm *(17.6 lb-in)*.

Module Dimensions

A coupling device has the following dimensions:



Note: When mounting the unit the support must be flat and smooth so as to prevent any undue stress on the unit which may lead to a loss of sealing.

Method

Follow the steps below:

Steps	Actions
1	Switch off the coupling device.
2	Remove the cover from the coupling device
3	Attach the coupling device using screws.
4	*Configuring the Address and Speed of the Splitter box, p. 63*
5	*Grounding, p. 31*
6	Place the cover on the coupling device without trapping or damaging it.
7	Tighten the three captive screws built into the cover. **Note:** The three screws must be tightened correctly to respect the IP67 protection index.
8	Switch on the coupling device.

⚠ WARNING

RISK OF NON-COMPLIANCE WITH IP67

For IP67 protection:

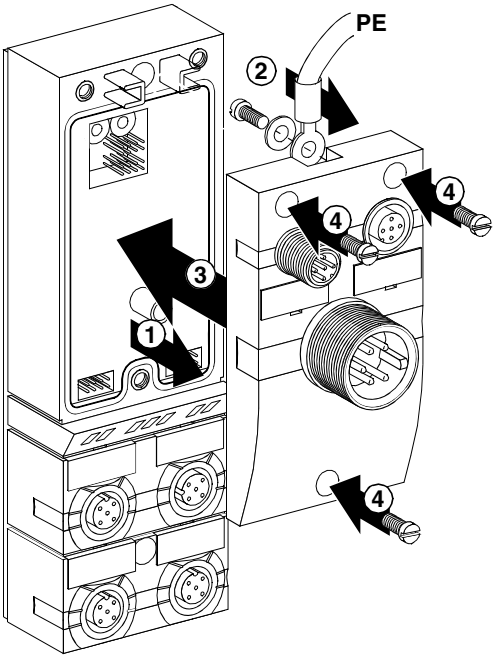
- Properly fit all connectors with cables or sealing plugs and tighten.
- Install cover onto coupling device and tighten captive screws to specified torque.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Grounding

Grounding the Coupling Device

The following figure shows the position of the ground electrode on the coupling device.



Note: Use a grounding strip or a conductor with a cross-section of 1 to 1.5 mm^2 *(AWG18, AWG16)* and length ≤ 3m *(9.84 ft)*. The maximum recommended length for the grounding strip is 3 m *(9.84 ft)*.

Method

Follow the steps below to connect the ground to the unit:

Step	Action
1	Remove the cover from the coupling device
2	Crimp the terminal on the earth cable and screw it on the cap.
3	Place the cover on the coupling device
4	Screw the three captive screws built into the cover.

Grounding the Splitter Boxes.

The ground connection is connected internally to pin 1 of the M12 connector of the internal bus connector.

If the unit is not grounded properly, it will be sensitive to electromagnetic disturbances. This may lead to unexpected equipment operation.

⚠ WARNING

RISK OF IMPROPER GROUNDING

Connect unit to ground using a conductor with cross-section 1...1.5 mm^2 *(18...16 AWG)* and a maximum length of 3 m *(9.84 ft)*. See *EMC Compatibility, p. 33*.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

EMC Compatibility

Product Compliance

CE

This product complies with the European directive 89/336/CEE on "electromagnetic compatibility".

The products described in this manual meet all the conditions regarding electromagnetic compatibility and are compliant with the applicable standards. However, this does not mean that the electromagnetic compatibility of your installation is assured.

This is why it is strongly recommended to follow all indications concerning an EMC compliant installation. Only in these conditions and thanks to the exclusive use of CE approved components, will the devices used be deemed as compliant with the EMC directives.

When handling the products, ensure that all safety measures related to electromagnetic compatibility and all conditions for the use of the products are complied with by all persons concerned. This is especially important when handling products sensitive to electrostatic discharges.

The products described in this manual contain highly complex semiconductors that can be damaged or destroyed by electrostatic discharges (ESD). If, for example, they are used within the vicinity of devices rated as class A or B according to IEC 61000-4-4, the level of electromagnetic interference may be enough to cause the device to operate unexpectedly, and/or to damage it.

Damage may not necessarily cause a failure or malfunction that is immediately detectable. It may occur sporadically or in a delayed manner.

⚠ WARNING

RISK OF UNINTENDED EQUIPMENT OPERATION

Where there is a risk of electromagnetic interference, the system designer must implement the necessary protective measures.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Grounding

A low impedance connection with a maximum length of 3 m *(9.84 ft)* must be installed between the splitter box's ground electrode and the reference ground in order to discharge the noise voltages. The inductance of standard grounding cables (PE) presents a risk of high impedance when high frequency noise voltages are present. It is therefore advisable to use grounding strips. If this solution is not possible, use a ground conductor with a large cable cross-section and a ground connection that is as short as possible.

If the unit is not grounded properly, it will be sensitive to electromagnetic disturbances. This may lead to unexpected equipment operation.

⚠ WARNING

RISK OF IMPROPER GROUNDING

Connect unit to ground using a conductor with cross-section 1...1.5 mm^2 *(18...16 AWG)* and maximum length 3 m *(9.84 ft)*.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Cable Routing

Make sure that the following basic wiring rules are followed:

- Keep the data wire and the power cables apart from one another, in so far as is possible.
- Make sure there is a space of at least 10 cm *(3.94 in)* between the data wires and the power cables.
- The data wires and power cables must only cross at a right angle to one another.
- It is advisable to route the data wires and power cables through separate shielded ducts.
- When laying the cables, the noise voltage from other devices or wires must be considered. This particularly applies to frequency converters, motors and other devices or cables generating high frequency disturbances. High frequency sources and the cables described in this manual must be as far apart from each other as possible.

⚠ WARNING

RISK OF UNINTENDED EQUIPMENT OPERATION

Please read and comply with the cabling rules listed above. Failure to comply with these wiring rules is a common cause of EMC problems.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Control of Inductive Loads

The outputs of the devices described in this manual are equipped with an integrated protective system against the high noise voltages that may be generated by inductive loads.

Integrated protective system against the high noise voltages generated by inductive loads

The varistor rapidly discharges the energy accumulated in the magnetic field of the inductive load.

The high voltages arising from the disconnection of inductive loads create large fields in the wires that may cause disturbances in nearby circuits or devices. It is advisable to provide an anti-interference device at the load level. In this way, the voltage peak generated by the inductive load is short-circuited directly at the point at which it occurs.

Installing a Splitter Box

Types of Screws and Tightening Torques

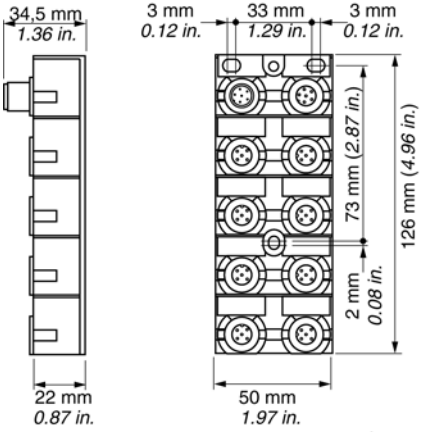
The splitter boxes are mounted using two 4 mm *(0.15 in.)* diameter screws and two washers. The tightening torque is 2 Nm *(17.6 lb-in)*.

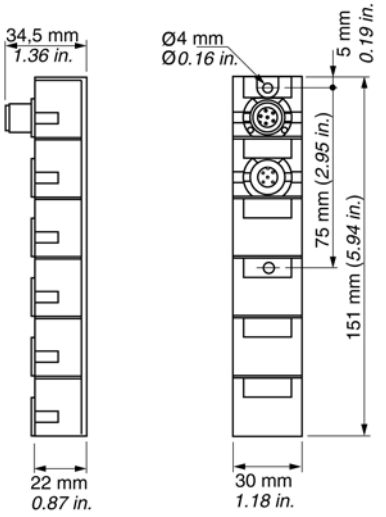
Dimensions of Extendable Splitter Boxes

The dimensions of the extendable splitter boxes are as follows:

Common view

FTM 1DD16C12E
FTM1DE16C12E





FTM 1D•08C12E
FTM 1D•08C08E

⚠ WARNING

RISK OF NON-COMPLIANCE WITH IP67

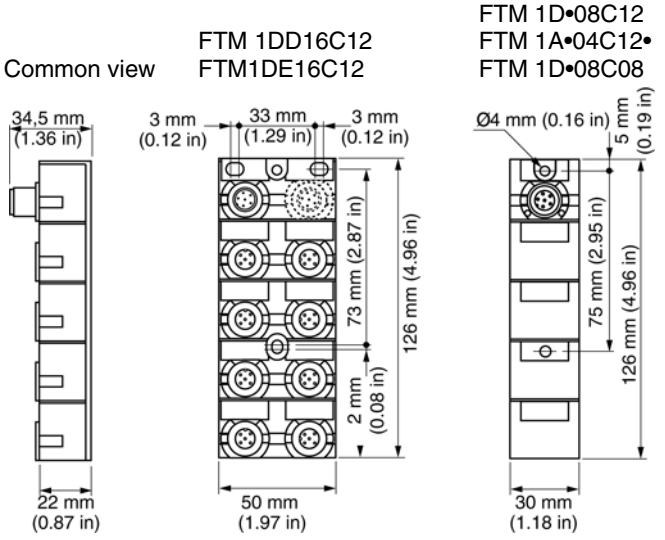
For IP67 protection:

- Properly fit all connectors with cables or sealing plugs and tighten.
- Install cover onto coupling device and tighten captive screws to specified torque.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Dimensions of Compact Splitter Boxes

The dimensions of the compact splitter boxes are as follows:



Operating Mode

Follow the steps below:

Steps	Actions
1	Remove the identification labels (see *Removing an Identification Label, p. 38*).
2	Attach the splitter box to the functional ground.
3	Mount the splitter box using the two screws.
4	Replace the identification labels in the corresponding module slots on the splitter box by pressing lightly.

Removing an Identification Label

Follow the steps below:

Steps	Actions
1	Insert a screwdriver under the open part of the label.
2	Remove the label by prising it off with the screwdriver.

⚠ WARNING

RISK OF NON-COMPLIANCE WITH IP67

For IP67 protection:

- Properly fit all connectors with cables or sealing plugs and tighten.
- Install cover onto coupling device and tighten captive screws to specified torque.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Properties and Wiring of FTM Coupling Devices

3

At a Glance

Introduction

This chapter provides an overview of FTM splitter boxes.

What's in this Chapter?

This chapter contains the following topics:

FTM Splitter box Environment Properties

Environment Characteristics

Characteristics	Description	Reference standards
Product certifications	cULus	-
Operating temperature	0 °C *(32 °F)*... 55 °C *(131 °F)*	-
Storage temperature	- 25 °C *(-13 °F)* ... 70 °C *(158 °F)*	-
Degree of protection	IP67	-
Altitude	0...2000 m *(0...6561 ft)*	According to IEC 529
Resistance to vibrations	0.15 mm *(0.0059 in)*	According to IEC 68-2-6, Fc test
Shock resistance	50 gn, duration: 11 ms	According to IEC 68-2-27, Fc test
Withstand capacity for electrostatic discharges	• Contact: ± 4 kV • Air: ± 8kV	According to IEC 61000-4-2
Withstand capacity for radiated fields	10 V/m	According to IEC 61000-4-3
Withstand capacity for fast transients	• Power supply: ± 2 kV • Signal: ± 2 kV	According to IEC 61000-4-4
Withstand capacity for surge	• Power supply (symmetrical and asymmetrical): ± 500V • Signals (symmetrical and asymmetrical): ± 1000V • PE: ± 500 V	According to IEC 61000-4-5
Withstand capacity for conducted fields	10 VAC rms	According to IEC 61000-4-6
Withstand capacity for 50 Hz magnetic fields	30 A/m *(9.15 A/ft)*	According to IEC 61000-4-8
Mounting	In all positions	-

Electrical Properties of Module

Electrical Characteristics

Characteristic	Description
Operating voltage	24 VDC
Bus and I/O under-voltage detection	< 18 VDC
Maximum supply current	9 A
Internal current draw	70 mA

How to Connect the Power Supply

Description

The power supply is connected using a 5-pin 7/8" connector.

This connector is used to supply power to the following elements:

- Coupling devices
- Splitter boxes
- Sensors
- Actuators

⚠ CAUTION

REVERSE POLARITY AND OVERCURRENT HAZARDS

- Do not supply 7/8” connector pins with more than 9A maximum current per pin.
- Do not reverse the polarity of the power supplied to the FTM coupling device.

Failure to follow these instructions can result in injury or equipment damage.

Power Supply for Coupling Devices, Splitter Boxes and Sensors

The splitter boxes require a voltage supply of 24 VDC (class 2).

It must comply with directives applicable to industrial power supplies.

Power Supply for Coupling Device

We advise you to use a switch mode power supply for the coupling device, sensors and actuators.

⚠ CAUTION

RISK OF IMPROPER POWER SUPPLY

The coupling device's power must be taken from the sensor power supply.

Failure to follow these instructions can result in injury or equipment damage.

Power Supply Ratings

The rating of the power supplies depends on the number and respective ratings of the connected devices.

⚠ WARNING

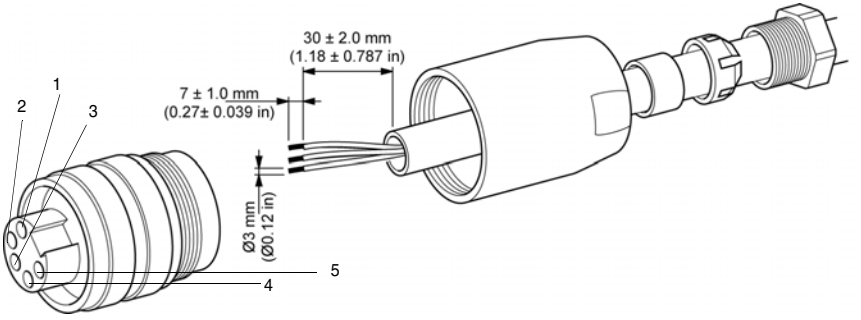
RISK OF UNINTENDED EQUIPMENT OPERATION

The system voltage must never be less than 18 VDC, regardless of the configuration.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

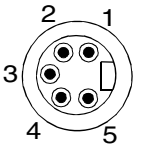
Assembling the Power Supply Cable

The following diagram describes the design characteristics and dimensions of the 7/8" power supply cable and the connector cable.



Pin Assignment

The following diagram shows a front view of the power supply connector for the coupling device:



Pin	Assignment
1	0 VDC
2	0 VDC
3	Ground (PE)
4	Bus sensor and power supply
5	Actuator power supply

Using the FTX DP21•• Cable

Pin No.	Wire No.	Signal
1	1	0 VDC
2	2	0 VDC
3	Green yellow	Ground (PE)
4	3	Sensors 24 VDC
5	4	Actuators 24 VDC

Maximum Current per Pin

The 7/8" connector is sized for a maximum current of 9 A per pin.

Phaseo Power Supply

A switch-mode power supply such as Phaseo (ABL 7•••) is particularly well-suited to supply automation systems. Its use is therefore highly recommended for FTB and FTM splitter boxes.

Internal Bus Connection

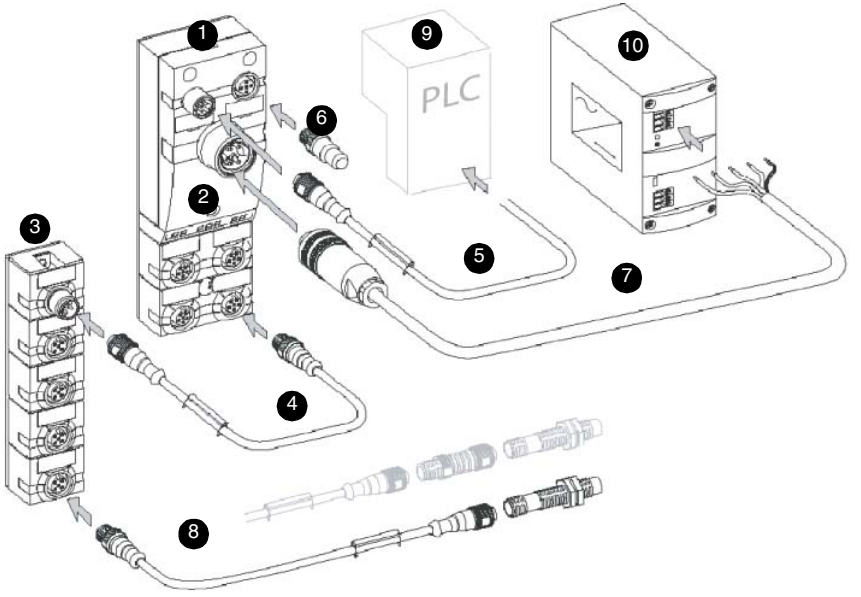
Internal Bus Connection

Internal bus connection fulfils two functions:

- Power supply for I/O FTM splitter boxes.
- Communication between the coupling device and the FTM I/O splitter boxes.

The internal bus between the coupling device and the I/O FTM splitter boxes must only be connected using pre-formed cables, available in different lengths (FTX CB32••).

Wiring Diagram



Element	Function
1	FTM Coupling Device
2	Coupling box cover
3	FTM splitter box
4	Internal bus cable
5	Incoming bus cable
6	Line terminator
7	Power supply wiring
8	M12 cable to detector or actuator
9	PLC
10	24 VDC Supply

Operating Mode

Using the wiring diagram shown above, follow the steps below:

Step	Action
1	Connect splitter box 3 to coupling device1 using internal bus cable 4.
2	Connect the M12 or M8 cables for the detectors or actuators to splitter box 3.
3	Connect incoming bus cable 5 to the "Bus In" connection point of cover 2.
4	Connect the outgoing bus cable to the following element or, if coupling device is the last element, connect a line terminator 6.
5	Connect the 24 VDC power supply 10 using the 7/8" connector.

Notes

Note: When tightening conductor screws, be careful to apply the recommended tightening torque of 0.5 Nm *(4.42 lb-in)*. Insufficient tightening of the field bus, internal bus, or I/O connections is a common cause of errors or malfunctions.

⚠ WARNING

RISK OF UNINTENDED EQUIPMENT OPERATION

- Do not exchange I/O modules within an installation.
- Identify and clearly mark the internal bus cables and the FTM I/O splitter boxes.
- In case of coupling device exchange for maintenance, keep the same network address.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Internal Bus Segment Terminator

Each segment of the internal bus must be terminated by a compact splitter box or an extendable splitter box with a line terminator. This line terminator is already built into each of the compact splitter boxes.

The connectors of all unused segments must have a line terminator.

FTM Splitter Box Properties and Wiring

4

At a Glance

Introduction

This chapter provides an overview of all FTM splitter boxes.

What's in this Chapter?

This chapter contains the following topics:

Electrical Properties of Discrete Splitter Boxes

Splitter Box Properties

Properties	Description
Splitter box's internal current draw	• 30 mA (M8) • 50 mA (M12)
Operating voltage	24 VDC
Maximum power current for the splitter box	4 A
Maximum auxiliary power current (only for FTM 1DD16C12)	4 A
Bus and I/O under-voltage detection	< 18 VDC

Input Characteristics

Characteristic	Description
Compliance with IEC 1131-2	Type 2
Compliance with P.D (Potential Difference) 2 wire/3 wire	Yes
Rated power voltage	24 VDC
Maximum current	200 mA
Sensor power supply	18...30 VDC
Logic	Positive
Filtering input	1 ms
Displaying channel status	Yellow LED, 1 LED per input
Reverse polarity protection	Yes

Output characteristics

Characteristic	Description
Output type	Transistors
Output voltage	24 VDC
Outgoing current	0.5 A
Response time	< 0.5 ms
Maximum switching cycle	• Resistive: 50 Hz • Inductive: 5 Hz
Maximum lamp load	10 W
Displaying channel status	Yellow LED, 1 LED per input
Connection for outputs / cable lengths	• 0.75mm^2 *(AWG 20)* / 10 m *(32.8 ft)* maximum • 0.34 mm^2 *(AWG 22)* / 5 m *(16.40 ft)* maximum

Connection of Actuators and Sensors to Discrete Splitter Boxes

Connection Properties

The sensors and actuators can be connected using either pre-formed cables or cables of your own making, provided they comply with the specifications for wires of cross-section < 0.75 mm^2 *(AWG 20)*.

⚠ WARNING

RISK OF NON-COMPLIANCE WITH IP67

For IP67 protection:

- Properly fit all connectors with cables or sealing plugs and tighten.
- Install cover onto coupling device and tighten captive screws to specified torque.

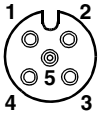
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Two sealing plugs are supplied with each splitter box and are available as accessories with the following product references:

- FTX CM12B (packet of 10 M12 sealing plugs).
- FTX CM08B (packet of 10 M8 sealing plugs).

Assignment of M12 Connector Pins

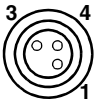
The following diagram shows the front view of a 5-pin M12 connector and the convention for numbering the pins:



Pin	Assignment
1	+24 VDC (detector power supply)
2	I/O signal
3	0 VDC (GND)
4	I/O signal
5	Functional ground (PE)

Assignment of the M8 Connector Pins

The following diagram shows the front view of a 3-pin M8 connector and the convention for numbering the pins:



Pin	Assignment
1	+24 VDC (detector power supply)
3	0 VDC (GND)
4	I/O signal

Connection of Y Connectors

Y connectors (FTX CY1212 and FTX CY1208) are only used with discrete input / output splitter boxes fitted with an M12 connector.

They can be used to connect two signals on each female connector (sensor/ actuator).

Electrical Characteristics of Analog Splitter Boxes

Splitter box Characteristics

Characteristic	Description
Splitter box's internal current draw	50 mA
Operating voltage	24 VDC
Maximum power current for the splitter box	4 A
Maximum power current per channel	• For inputs: ≤ 0.2 A • For outputs: ≤ 1.6 A
Bus and I/O under-voltage detection	< 18 VDC

Input properties

Properties	Description of FTM 1AE04C12C	Description of FTM 1AE04C12T
Type	300 Ω differential	FTM 1AE04C12T: 1 MΩ differential
Measurement range	• 0...20 mA • 4...20 mA	• +/-10 VDC • 0...10 VDC
Resolution	15 bits	15 bits + sign
Conversion time	≤ 2 ms / channel	
Input filter	1 ms	
Displaying channel status	By LED	
Connection for inputs / cable lengths	30 m *(98.42 ft)* maximum	

Output characteristics

Properties	Description of FTM 1AS04C12C	Description of FTM 1AS04C12T
Type	300 Ω Differential	1 MΩdifferential
Measurement range	• 0...20 mA • 4...20 mA	• +/-10 VDC • 0...10 VDC
Resolution	11 bits	11 bits + sign
Conversion time	≤ 1 ms / channel	
Displaying channel status	By LED	
Connection for outputs / cable lengths	30 m *(98.42 ft)* maximum	

Connection of Actuators and Sensors to Analog Splitter Boxes

Connection Properties

The sensors and actuators can be connected using either pre-formed cables or cables of your own making, provided they comply with the specifications for wires of cross-section ≤ 0.75 mm^2 *(AWG 20)*.

The shielding is provided by the metal thread of the female M12 connector For this reason, we recommend that you only use female M12 connectors with metal threads The shielding must be connected to connector's metal sleeve.

⚠ WARNING

RISK OF NON-COMPLIANCE WITH IP67

For IP67 protection:

- Properly fit all connectors with cables or sealing plugs and tighten.
- Install cover onto coupling device and tighten captive screws to specified torque.

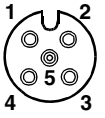
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Two sealing plugs are supplied with each splitter box and are available as accessories with the following product references:

- FTX CM12B (packet of 10 M12 sealing plugs).
- FTX CM08B (packet of 10 M8 sealing plugs).

Assignment of M12 Connector Pins

The following diagram shows the front view of a 5-pin M12 connector and the convention for numbering the pins:



Pin	Analog IN assignment	Analog OUT assignment
1	+24 VDC (detector power supply)	+24 VDC (detector power supply)
2	Analog input +	Not used
3	0 VDC (GND)	0 VDC (GND)
4	Analog input -	Analog output
5	Not used	Not used

CANopen network interface

5

Presentation

Introduction

This chapter provides theoretical elements for CANopen operations.

What's in this Chapter?

This chapter contains the following sections:

5.1 Wiring on the CANopen Bus

Presentation

Introduction

The following section describes wiring on the CANopen bus.

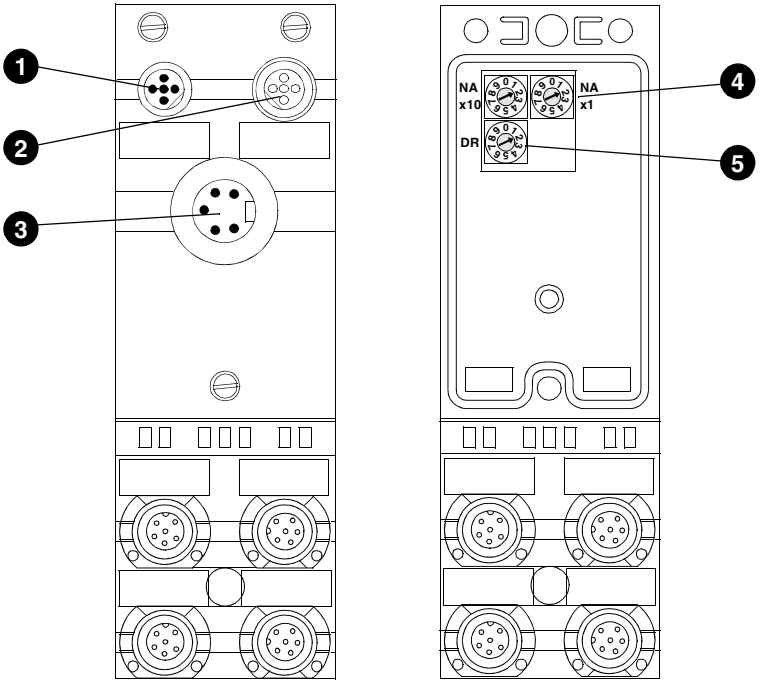
What's in this Section?

This section contains the following topics:

Introduction to Wiring on the CANopen Bus

Introduction

The physical characteristics necessary for the CANopen bus to operate are given in the following illustration:



Description		Function	See
1	M12 Connector	CANopen bus connector (Bus IN)	*Connecting the Field Bus, p. 61*
2	M12 Connector	CANopen bus connection (Bus OUT)	
3	7/8" connector	24V power supply connection	*How to Connect the Power Supply, p. 42*
4	Rotary switches	Selecting the splitter box address	*Configuring the Address and Speed of the Splitter box, p. 63*
5	Rotary switch	Selecting transmission speed	

Topology

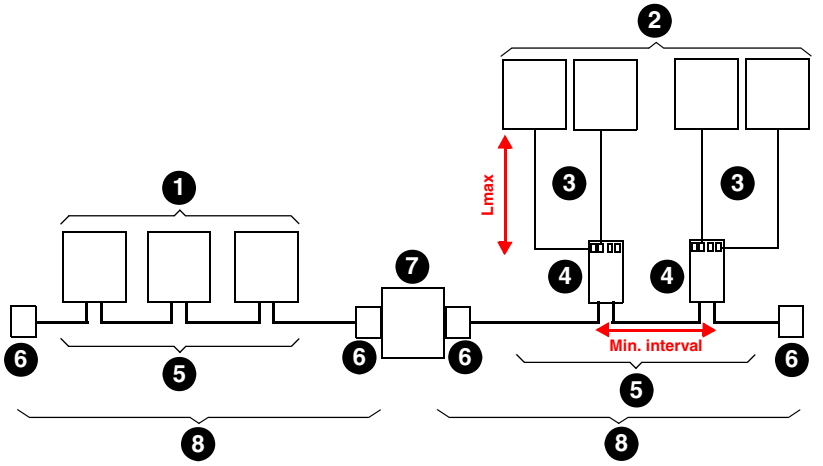
Architecture

The CANopen network architecture must comply with the following limitations:

- bus length / transmission speed (See *Transmission Speed, p. 60*),
- number of connected devices (See *Number of Connected Devices, p. 59*),
- length of the taps and the space between two taps (See *Tap Length, p. 58*),
- line terminator (See *Line Terminator Resistance, p. 60*).

The connections to the CANopen bus may be of the chaining or tap type.

The following illustration shows a CANopen network architecture:



The table below describes the components of a CANopen network:

Number	Description
1	CANopen devices connected by chaining
2	CANopen devices connected by tap
3	Drop cables (tap junction box / device)
4	Tap junction boxes
5	Chaining cables
6	Line terminator
7	Repeater (identical arbitration on the different bus segments) or Bridge (different arbitration on the different bus segments)
8	CANopen bus segment

Note: A single line architecture is recommended to reduce signal reflection. Avoid using star-type architecture.

Tap Length

A tap creates a signal reflection and thus its length must be limited to the following parameters:

Lmax is the maximum length of a tap.

Σ**LImax** is the maximum value of the sum of all taps on the same tap junction box.

Min interval is the minimum distance necessary between two taps.

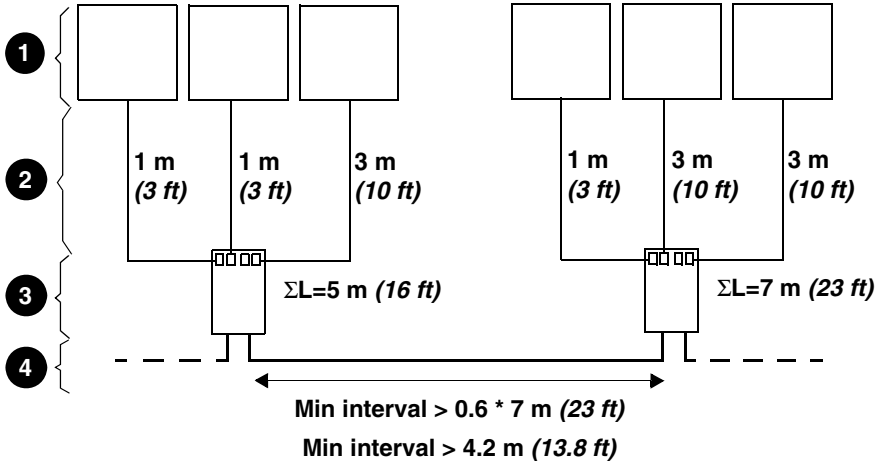
Σ**LGmax**is the maximum value of the sum of all taps on the segment.

The values to use are given in the following table:

Speed	**Lmax**	**ΣLImax**	**Min. interval 0,6xΣL local**	**ΣLGmax**
1 Mbit/s	0.3 m *(0.98 ft)*	0.6 m *(1.96 ft)*		1.5 m *(4.9 ft)*
800 Kbits/s	3 m *(9.8 ft)*	6 m *(19.6 ft)*	3.6 m *(11.8 ft)*(*)	15 m *(49 ft)*
500 Kbits/s	5 m *(16.4 ft)*	10 m *(32.80 ft)*	6 m *(19.6 ft)*(*)	30 m *(98.4 ft)*
250 Kbits/s	5 m *(16.4 ft)*	10 m *(32.80 ft)*	6 m *(19.6 ft)*(*)	60 m *(196.8 ft)*
125 Kbits/s	5 m *(16.4 ft)*	10 m *(32.80 ft)*	6 m *(19.6 ft)*(*)	120 m *(393.6 ft)*
50 Kbits/s	60 m *(196.8 ft)*	120 m *(393.6 ft)*	72 m *(236 ft)*(*)	300 m *(984 ft)*
20 Kbits/s	150 m *(492 ft)*	300 m *(984 ft)*	180 m *(590.5 ft)*(*)	750 m *(2460.6 ft)*
10 Kbits/s	300 m *(984 ft)*	600 m *(1968.4 ft)*	360 m *(1181 ft)*(*)	1500 m *(4921 ft)*
Legend:				
(*) The minimum cable length between two consecutive tap junction boxes must be greater than 60% of the largest of the two sums of the lengths of taps on each of the two boxes.				

Example

The following illustration shows the calculation of the length of a cable located between two tap junction boxes



The table below describes the components of a CANopen network:

Number	Description
1	Connected CANopen devices
2	Drop cables (tap junction box / device)
3	Tap junction boxes
4	Connection cables (tap junction box / tap junction box)

In this example, we have two tap junction boxes and 6 devices. We start by calculating the sum of the lengths of cables for each tap junction box, and we obtain 5 m *(16 ft)* and 7 m *(23 ft)*. We keep the longest length, i.e. 7 m *(23 ft)*. The minimum length of the cable between the two tap junction boxes is equal to 60% of 7 m, i.e. 4.2 m *(13.8 ft)*.

Number of Connected Devices

In addition to the length limitations over the whole of the CANopen bus, the following limitations apply:

- Whatever the case, no more than 64 devices may be connected on the same segment.
- Two segments must be separated by a repeater.
- The number of devices connected to a full system depends on the CANopen master and cannot exceed 127.

Choice of system cables

Transmission Speed

The maximum allowable transmission speeds are given in the following table:

Transmission speed (Kbit/s)	Cable length
1000	20 m *(65.62 ft)*
800	40 m *(131.23 ft)*
500	100 m *(328 ft)*
250	250 m *(820 ft)*
125	500 m *(1640.4 ft)*
50	1000 m *(3280 ft)*
20	2500 m *(8202 ft)*
10	5000 m *(16 404 ft)*

Specific Resistance

The specific resistance of the cables shoudl be below 70 mΩ/m.

Line Terminator Resistance

To minimize the voltage drop in the connection, it is advisable to use a higher line terminator resistance for high length cables than that specified by the standard ISO11898-2. When configuring the system, the connector resistances must also be taken into consideration. The potential difference at the CAN_GND connections of all the CANopen bus items must not be greater than 2 VDC.

⚠ WARNING

RISK OF UNINTENDED EQUIPMENT OPERATION

Connect a 120 Ω line terminator between CAN_H and CAN_L at the line end (see *Physical Layer, p. 66*).

Failure to follow these instructions can result in death, serious injury, or equipment damage.

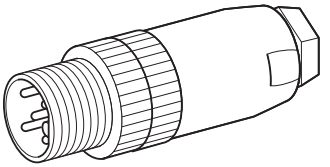
Connecting the Field Bus

Description

The coupling device can either be in the middle of the chain connection or at the line end. The field bus is connected via a 5-pin M12 connector.

Illustration of the Connection Cable Connector

The following diagram shows the characteristics of the connection cable connector:

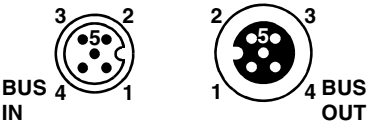


Bus Connector Pin Assignment

The BUS IN connector is a 5-pin M12 male connector.

The BUS OUT connector is a 5-pin M12 female connector.

The following diagram shows a front view of the bus connectors:



The following table gives the assignments of the bus connector pins:

Pin	Signal	Meaning
1	(CAN_SHLD)	Optional CAN shielding
2	(CAN_V+)	NC (not connected)
3	CAN_GND	0 V
4	CAN_H	CAN_H bus line
5	CAN_L	CAN_L bus line

Note: Pin 1 is connected to the ground connection terminal of the coupling device.

⚠ WARNING

RISK OF NON-COMPLIANCE WITH IP67

For IP67 protection:

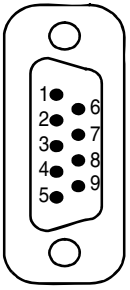
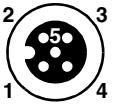
- Properly fit all connectors with cables or sealing plugs and tighten.
- Install cover onto coupling device and tighten captive screws to specified torque.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Correspondence between 9-pin SUB-D Connectors and M12 5-pin Connectors

The bus connector on IP20 products is a 9-pin SUB-D connector (e.g. Advantys OTB CANopen).

The following table shows the correspondence between pins on 9-pin SUB-D connectors and on 5-pin M12 connectors:

9-pin SUB-D connector	SUB-D pin	Signal	Meaning	M12 pin	5-pin M12 connector
	1	-	Reserved	-	
	2	CAN_L	CAN_L bus line	5	
	3	CAN_GND	0 V	3	
	4	-	Reserved	-	
	5	(CAN_SHLD)	Optional CAN shielding	1	
	6	(GND)	Optional CAN_V-	-	
	7	CAN_H	CAN_H bus line	4	
	8	-	Reserved	-	
	9	(CAN_V+)	Optional power supply	-	

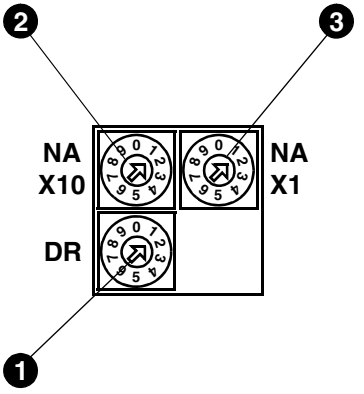
Method

Follow the steps below:

Step	Action
1	Connect the chaining cable to the BUS IN connector.
2	If the coupling device is at the end of the line, connect a line terminator resistor to the BUS OUT connector. Otherwise, connect a chaining cable to the BUS OUT connector.

Configuring the Address and Speed of the Splitter box

Illustration of the Rotary Switches



Element	Function
1	Transmission speed (kBit/s)
2	Node-ID x 10 switch
3	Node-ID x 1 switch

Operating Mode

Modifications will only be taken into account at the next power up. Follow the steps described below:

Step	Action
1	Switch off the coupling device.
2	Unscrew the three screws on the cover.
3	Set the communication speed.
4	Set the splitter box address.
5	Screw the cover back on.

Assignment of the Address on the Network

The CANopen address is configured using two specially designed rotary switches. Addresses can be configured from 1 to 99. Address zero (0) cannot be used.

Note: When assigning the addresses, ensure that each node is assigned to a single specific address. A configured address is registered at power up. It cannot be changed if you do not remove the cover. No LED lights up if address 0 is selected in error.

Adjustment of the Transmission Speed

The transmission speed is configured using a rotary switch.

The following transmission speeds are possible:

Position of the encoder wheel	Transmission speed
0	Automatic recognition
1	10 Kbits/s
2	20 Kbits/s
3	50 Kbits/s
4	100 Kbits/s
5	125 Kbits/s
6	250 Kbits/s
7	500 Kbits/s
8	800 Kbits/s
9	1 Mbits/s

Note: When adjusting the transmission speed, ensure that each CANopen element is set to the same speed.
The configured transmission speed is registered at power-up. It cannot be changed if you do not remove the cover.

⚠ CAUTION

RISK OF EQUIPMENT MALFUNCTION

At least one slave must be set at a fixed speed so that the other slaves set to automatic recognition mode will operate correctly. In the opposite case, where the slaves set to automatic recognition remain in "Pre-Operational" mode, the devices may not operate correctly.

Failure to follow these instructions can result in injury or equipment damage.

5.2 General Principles

Presentation

Introduction

This section addresses the general principles for operating and using the CANopen network.

What's in this Section?

This section contains the following topics:

About CANopen

Introduction

CANopen is a standard fieldbus protocol for industrial control systems. It is particularly well suited to real-time PLCs, as it provides an effective, low-cost solution for industrial applications.

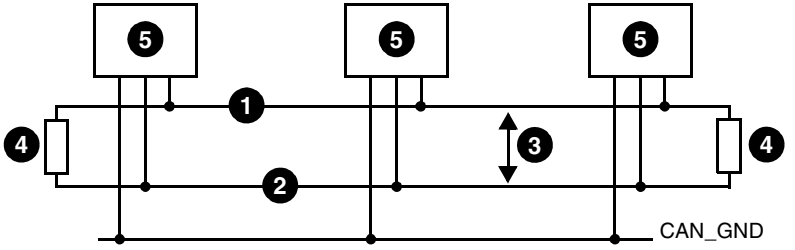
The CANopen Protocol

The CANopen protocol was created as a subset of CAL (CAN Application Layer). By defining profiles, it is able to be even more specifically adapted to use with standard industrial components. CANopen is a CiA standard (CAN in Automation) that was very quickly adopted by users when it was put on the market. In Europe, CANopen is now recognized as the industry standard for industrial systems based on a CAN design.

Physical Layer

CAN uses a differentially driven two-wire bus line (common return). A CAN signal is the difference between the voltage levels of the CAN_H and CAN_L wires. (See figure below.)

The following diagram shows the components of the physical layer of a three-wire CAN bus:



1 CAN_H wire
2 CAN_L wire
3 Potential difference between CAN-H/CAN-L signals
4 Line terminator 120 Ω
5 Connected devices,

The bus wires can be routed in parallel, twisted or shielded form in accordance with electromagnetic compatibility requirements.

CANopen Profiles

The communication profile

The CANopen communication protocol is based on a "communication profile", which specifies the main communication mechanisms and their description (DS301).

The device profile

The most important types of devices used in industrial automation are described in the "Device profiles". They also define device functionalities.

Here are some examples of standard devices:

- Discrete and analog input/output splitter boxes (DS401)
- Motors (DS402)
- Control devices (DSP403)
- Closed loop controllers (DSP404)
- PLCs (DS405)
- Encoders (DS406)

Device Configuration via the CAN Bus

The possibility of configuring devices via the CANopen bus is one of the basic principles of the autonomy required by manufacturers (for each profile family).

General Specifications for CANopen Profiles

CANopen is a set of profiles for CAN systems with the following specifications:

- An open bus system
- Real-time data exchange without protocol overload
- A modular design with the possibility of resizing
- Interoperability and interchangeability of devices
- Support guaranteed by a large number of international manufacturers
- A standardized network configuration
- Access to all device parameters
- Synchronization and circulation of cyclical process data and/or event-driven data (possibility of short system response times).

CANopen Product Certification

All manufacturers offering CANopen-certified products on the market are members of the CiA (CAN in Automation) industrial consortium. As an active member of the CiA consortium, Schneider Electric develops its products in compliance with standard recommendations recognized internationally by the CiA consortium.

CAN Standards

CANopen specifications are defined by the CiA association and are available on the site site www.can-cia.de. The master and slave source codes are available from different suppliers.

Note: To learn more about specifications and standard mechanismsCANopen, go to the homepage of the CiA (http//www.can-cia.de).

Communication on a CANopen Network

The communication profile is based on CAL (CAN Application Layer) services and protocols.

It provides the user with access to two types of exchange: SDO (Service Data Object) and PDO (Process Data Object).

On power up, the device enters an initialization phase then goes into "Pre-operational" state. At this stage, only SDO communication is authorized. After receiving a startup command, the device switches to the "Operational" state. PDO and SDO communications are both authorized when the device is in the "Operational" state.

The Device Profile

List of Functions

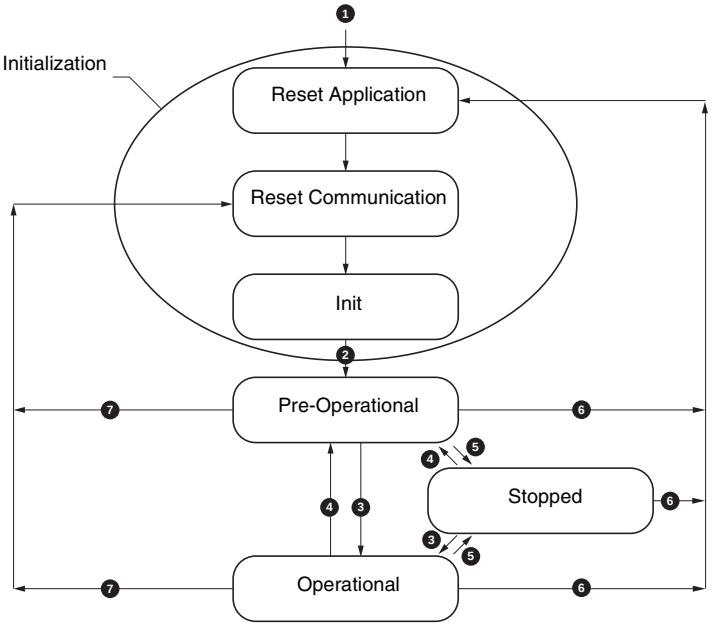
The list of functions supported and their coding are given in the following table:

Function	Function code (binary)	Resulting COB-ID (Hex)	Resulting COB-ID (Dec)
NMT	0000	0	0
SYNC	0001	80	128
EMERGENCY	0001	81 - FF	129 - 255
TPDO1 (tx)	0011	181- 1FF	385 - 511
RPDO1 (rx)	0100	201- 27F	513 - 639
TPDO2 (tx)	0101	281 - 2FF	641 - 767
RPDO2 (rx)	0110	301 - 37F	769 - 895
TPDO3 (tx)	0111	381 - 3FF	897 - 1023
RPDO3 (rx)	1000	401 - 47F	1025 - 1151
TPDO4 (tx)	1001	481 - 4FF	1153 - 1279
RPDO4 (rx)	1010	501 - 57F	1281 - 1407
SDO (tx)	1011	581 - 5FF	1409 - 1535
SDO (rx)	1100	601 - 67F	1537 - 1663
NMT Error Control	1110	701 - 77F	1793 - 1919

CANopen "Boot-Up"

Procedure for "Boot-Up"

The minimum configuration of the equipment specifies a shortened boot procedure. This procedure is illustrated by the following diagram (excerpt of the DS 301 standard). Detailed device behavior is described in the following chapters :



Number	Description
1	Device power-up
2	After initialization, the device automatically goes into the PRE-OPERATIONAL state
3	NMT service indication: START REMOTE NODE
4	NMT service indication: ENTER PRE-OPERATIONAL
5	NMT service indication: STOP REMOTE NODE
6	NMT service indication: RESET NODE
7	NMT service indication: RESET COMMUNICATION

NMT : Network Management Telegram

Active CANopen Objects depending on State Machine

The crosses in the table below indicate which CANopen objects are active for which states of the state machine:

	Initialisation	Pre-Operational	Operational	Stopped
PDO object:			X	
SDO object:		X	X	
Emergency		X	X	
Boot-Up	X			
NMT		X	X	X

"Reset Application"

The device goes into the "Reset Application" state:

- after the device starts up or,
- by "RESET NODE" (NMT service,Network Management Telegram).

In this state, the device profile is initialized, the device profile data is reset to the last saved value. When initialization is complete, the device automatically goes into the state "Reset Communication".

"Reset Communication"

The device goes into the "Reset Communication" state:

- after the "Reset Application" state,
- by "RESET COMMUNICATION" (NMT service).

In this state, all the parameters (standard value, depending on the device configuration) of the supported communication objects (1000H - 1FFFH) are saved in the object directory. The device then automatically goes into the "Init" state.

"Init"

The device goes into "Init" mode after being in the "Reset Communication" state.

This state enables you to:

- define the required communication objects (SDO, PDO, Sync, Emergency),
- install the corresponding CAL services
- configure the CAN-Controller.

Initialization of the device is complete and the device automatically goes into the "Pre-Operational" state and sends a "Boot-Up" message.

"Pre-Operational"

The device goes into the "Pre-Operational" state:

- after the "Init" state,
- on receiving the NMT "ENTER PRE-OPERATIONAL" indication if it was in the "Operational" or "Stopped" state.

When the device is in this state, its configuration can be modified. However, only SDOs can be used to read or write device-related data.

When configuration is complete, the device goes into one of the following states on receiving the corresponding indication:

- "Stopped" on receiving the NMT "STOP REMOTE NODE" indication.
- "Operational" on receiving the NMT "START REMOTE NODE" indication.

"Stopped"

The device goes into the "Stopped" state on receiving the "STOP REMOTE NODE" indication (NMT service) if it was in "Pre-Operational" or "Operational" state.

In this state, the device cannot be configured. No service is available to read and write device-related data (SDO). Only the slave monitoring function ("Node-Guarding" or "Heartbeat") remains active.

"Operational"

The device goes into the "Operational" state if it was in the "Pre-Operational" or "Stopped" state on receiving "START REMOTE NODE" indication.

During startup of the CANopen network using the NMT "START REMOTE NODE" services, all functions of the device can be used. Communication can be carried out via PDOs or SDOs.

⚠ WARNING

RISK OF UNINTENDED DEVICE OPERATION

- Do not change the device configuration when it is in “Operational” state.
- To reconfigure the device, put it in the “Pre-Operational” state first and confirm it has entered this state before attempting reconfiguration.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Process Data Object (PDO) Transmission

Definition of PDO

PDOs are objects which provide the communication interface with process data and enable them to be exchanged in real time. A CANopen device's PDO set describes the implicit exchanges between this device and its communication partners on the network.

The exchange of PDOs is authorized when the device is in "Operational" mode.

Types of PDO

There are two types of PDO:

- PDOs transmitted by the device ("Transmit PDO", "TPDO")
- PDOs received by the device ("Receive PDO", "RPDO")

PDO Consumer/ Producer

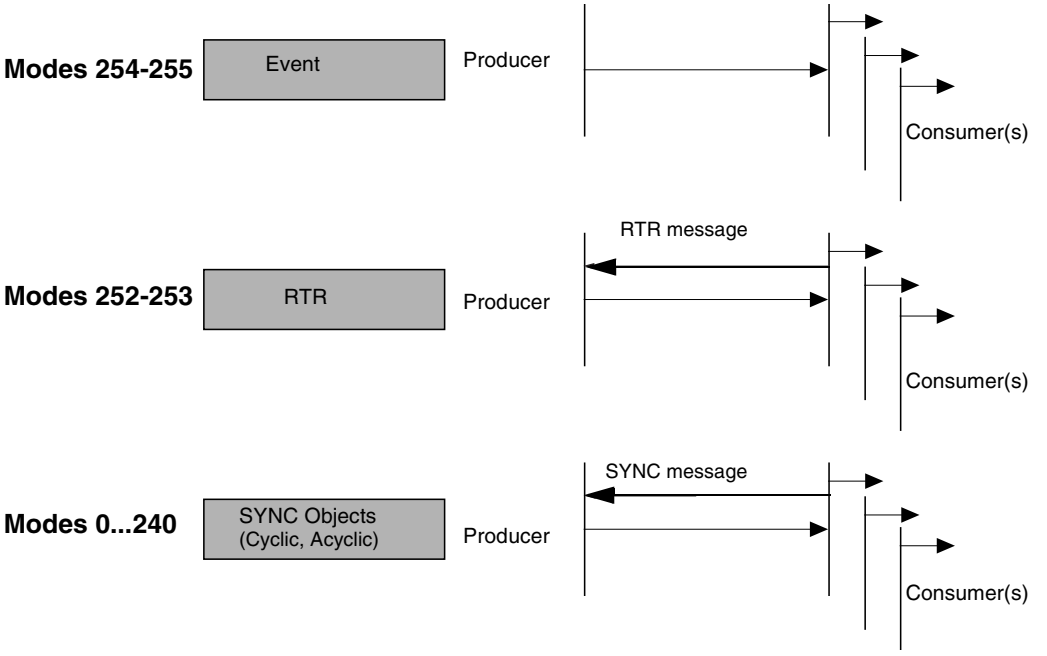
PDO s are based on the "Producer/consumer" model. The device which sends out a PDO is called the producer, while the device receiving it is known as the consumer.

PDO Transmission Modes

In addition to data to be transported, it is possible to configure the type of exchange for each PDO.

The PDO transmission mode can be configured as described in the table below.

Transfer code		Transmission mode					Notes
Dec.	**Hex.**	**Cyclic**	**Acyclic**	**Synchronous**	**Asynchronous**	**only RTR**	
0	0		x	x			Send PDO on first SYNC message following an event
1 to 240	1 to F0	x		x			Send PDO every x SYNC messages
241 to 251	F1 to FB	Reserved					-
252	FC			x		x	Receive SYNC message and send PDO on RTR
253	FD				x	x	Data update and sending of PDO on RTR
254 to 255	FE to FF				x		Send PDO on event (Change of state mode)

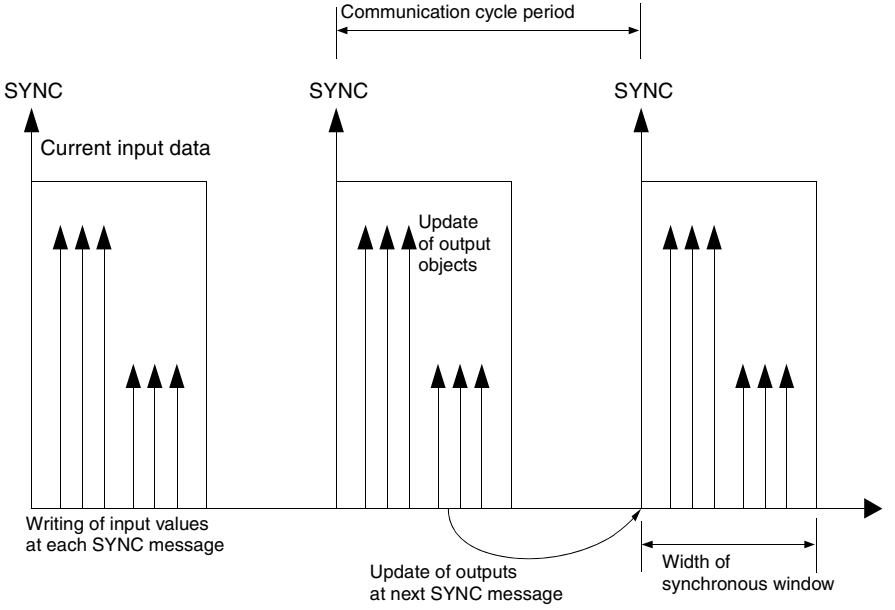


Synchronous (mode 0 to 240)

For certain applications, synchronization between scanning of the inputs and activation of the outputs may be necessary.

For this reason, CANopen provides the "SYNC" object, a high-priority CAN message without any working data, which, when it is received by the synchronized devices is used to trigger the reading of inputs or activation of outputs (Trigger).

The following diagram shows the time data for synchronized PDO transmission.



Synchronous RTR (mode 252)

The master can poll slaves by using data request messages ("Remote-Frames", called RTR messages).

In mode 252 the device sends the TPDO upon receipt of the synchronization message that follows the RTR message.

Asynchronous RTR (mode 253)

In mode 253, the TPDOs are transmitted once the RTR message is received.

"Change of state" (modes 254 and 255)

The asynchronous exchange of PDO in "Change of state" mode enables the rapid modification of an input value, followed by immediate confirmation of the change of value. This avoids the need to wait for the master to send a request.

A high priority bus status is assigned to the "Change of state" mode and only the updated input value is returned, not the image of the full process, thus considerably reducing traffic on the bus.

"Change of state" corresponds to the modification of the input value (event control).

⚠ WARNING

RISK OF UNINTENDED DEVICE OPERATION

The "Change of State" mode must not be used for inputs/outputs whose state changes continuously (such as analog inputs). The continual modification of I/Os using the "Change of State" mode may block the transmission of other crucial commands, resulting in the unintended operation of the device.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Inhibit Time and Event Timer

Inhibit Time

In event transmission mode, the Inhibit Time utility is used to define a minimum time delay before transmission of a new PDO. This avoids overloading the bus where a significant number of events occur in rapid succession.

The Inhibit Time is expressed in multiple of 100 µs.

Values (hex.)	Values (dec.)	Actual values (ms)
0000H	0	0000
000AH	10	1
0064H	100	10
03E8H	1000	100
2710H	10 000	1000
FFFFH	65 535	6553.5

Event Timer

In event transmission mode, the Event Timer is used to define an expiry time delay where transmission of a PDO will be forced, even if there has been no change in status .

The Event Timer is expressed in milliseconds.

Values (hex.)	Values (dec.)	Actual values (ms)
0000H	0	0 (deactivated)
000AH	10	10
0064H	100	100
01F4H	500	500
03E8H	1000	1000
1388H	5000	5000
2710H	10 000	10 000

Access to Data by Explicit Exchanges (SDO (Service Data Object))

What is an SDO?

An SDO allows a device's data to be accessed by using explicit requests.

The SDO service is available when the device is in "Operational" or "Pre-Operational" state.

Types of SDO

There are two types of SDO:

- Read SDOs (Download SDO)
- Write SDOs (Upload SDO)

The Producer/ Consumer Model

The SDO protocol is based on a 'Producer/Consumer' model.

For a Download SDO

The client sends a request indicating the object to be read.

The server returns the data contained within the object.

For an Upload SDO

The client sends a request indicating the object to be written to and the desired value.

After the object has been updated, the server returns a confirmation message.

For an unprocessed SDO

In both cases, if an SDO was not able to be processed, the server returns an error code (Abort Code).

"Node-Guarding" and "Life-Guarding" Monitoring Protocols

Introduction

Error monitoring protocols are used to detect communication errors on the network. The default monitoring method, "Node-Guarding", consists in the master controlling the slaves. It is possible to add "Life-Guarding" control of the master by the slaves.

Note: The simultaneous use of both monitoring methods, "Guarding" and "Heartbeat", is impossible. Should both methods be activated at once, the equipment will only use the "Heartbeat" monitoring method.

Definition of "Life-Time"

The "Life-Time" parameter is calculated as follows:

"Life-Time"= "Guard-Time" x "Life-Time-Factor"

The object 100CH contains the ''Guard-Time'' parameter expressed in milliseconds. The object 100DH contains the ''Life-Time-Factor" parameter.

Activation of Monitoring

When one of the two parameters "Life-Time-Factor" or "Guard-Time" is set to "0" (default configuration), the device does not perform monitoring (no "Life-Guarding").

To activate monitoring over time, you must enter a value (minimum 1) in the object 100DH and specify a time in ms in the object 100CH.

Common typical values for the "Guard-Time" parameter lie between 250 ms and 2 s.

Reliable Operation

To enable reliable and secure operation, the user must enter a "Life-Time-Factor" with a minimum value of 2.

When the value 1 is used, should a delay occur due to the processing of high priority messages or internal processing on the "Node-Guarding" master, the device switches back to the "Pre-Operational" default state without generating any errors.

⚠ WARNING

RISK OF UNINTENDED DEVICE OPERATION

Set the "Life-Time-Factor" (object 100DH) to a minimum value of 2 to prevent any inadvertent change of state to "Pre-Operational" state.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Importance of Monitoring

These two monitoring mechanisms are especially important in the CANopen system. Devices connected to the bus do not regularly indicate their presence in operating mode, commanded by "Event".

Slave Monitoring

Monitoring is performed in the following way:

Phase	Description
1	The master sets "Remote-Frames" (or "Remote-Transmit-Request" request messages) on the "Guarding-CobID" of the slaves to be monitored.
2	The slaves concerned respond by sending the "Guarding" message. This message contains the "Status-Code" of the slave and the "Toggle-Bit", which changes after each message.
3	The NMT (Network Management Telegram) master compares the "Status"and "Toggle-Bit" information: If they are not in the expected state or if no response is received, the NMT master considers that an error has occurred on the slave.

Master Monitoring

If the master requests "Guarding" messages on a strictly cyclical basis, the slave can detect a master failure.

If the slave does not receive a request from the master within the defined "Life-Time" interval ("Guarding" error), it considers that a master failure has occurred ("Watchdog" function).

In this case, the corresponding outputs go into fallback mode and the slave switches back into "Pre-Operational" mode.

⚠ WARNING

WRONG FALLBACK VALUES CONFIGURATION

The person in charge for configuring the system must configure the slave outputs fallback modes and values to provide safe fallback operations in the event of a loss of master/slave communication.
The person in charge for configuring the system must also take all necessary measures for providing equipment and personnel safety should it prove impossible to secure the fallback operations.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

"Guarding" Protocol

The initial value of the "Toggle-Bit" sent in the first "Guarding" message is "0".

Then, the "Toggle" bit changes in each subsequent "Guarding" message, which makes it possible to indicate if a message has been lost.

The network state of the device is indicated in the seven remaining bits:

Network state	Response in hex.
Stopped	04H or 84H
Pre-operational	7FH or FFH
Operational	05H or 85H

The "Heartbeat" Error Monitoring Protocol

Operation of "Heartbeat" Mechanism

The default monitoring method is "Node-Guarding". If a non-zero value is written in the object 1017H, the "Heartbeat" mechanism is used.

If the Heartbeat error monitoring protocol is selected, the producer transmits a "Heartbeat" message periodically, depending on the "Producer Hearbeat Time" parameter.

The devices responsible for monitoring this message ("Heartbeat Consumer") generate a "HeartBeat" event if the message is not received in the configured time ("Consumer Heartbeat Time").

Note: The simultaneous use of two monitoring methods, "Guarding" and "Heartbeat", is not possible. In case both methods are activated simultaneously, the device will only use the "Heartbeat" monitoring method.

Meaning of Possible Values

The message "Heartbeat" indicates the device status on a byte that is broken down as follows:

- The most significant bit is reserved and always has a value of 0
- The 7 least significant bits provide the status for the device producing the "Heartbeat" message.

The possible values are as follows:

Status of the "Heartbeat Producer"	Value (Decimal)
Boot-Up	0
Stopped	4
Operational	5
Pre-Operational	127

5.3 Behavior patterns of the Advantys FTM CANopen Modular Splitter Box

At a Glance

Introduction

The following sections address the different behavior patterns of the Advantys FTM CANopen modular splitter box and the saving of different parameters.

What's in this Section?

This section contains the following topics:

Module Behavior at Boot-up

At a Glance

This chapter describes the behavior of the coupling device during boot-up as well as its behavior in the event of an internal bus operating error.

Boot-up

Behavior during boot-up is in compliance with the CANopen Boot-Up diagram described above. See *CANopen "Boot-Up", p. 70*

During the initialization phase, the FTM coupling device searches for splitter boxes connected to the internal bus. Once the internal bus has been initialized, the FTM coupling device can switch to pre-operational state.

If there is no back-up configuration, the FTM coupling device initializes the CANopen data with the default parameters. Where a back-up has been carried out, the saved parameters are applied prior to switching to a pre-operational state.

If the saved parameters are incompatible with the physical configuration of the splitter boxes connected to the internal bus, then none of the saved parameters are applied: the default parameters are selected. This situation may occur if a splitter box has been replaced by one with another reference number, or if the internal bus has not been properly reconnected after modifications have been performed.

Internal Bus Error

If an error appears on the internal bus, the FTM coupling device leaves operational state on the CANopen bus and the exchange of PDOs is no longer possible.

When all errors have disappeared from the internal bus, the outputs automatically take the value of objects 6200H.

If a physical configuration error is detected (splitter box inoperative or missing, for example), the fallback values are applied to the outputs.

Behavior in the Case of Communication Error

Description

In the event of a communication error detected by one of the error monitoring protocols ("Node-Guarding" or "Heartbeat"), fallback values are applied physically on the outputs until the next write of the output command object and when the communication error has disappeared.

Saving / Restoring Parameters

Management of Saved Parameters

During initial power up, the Advantys splitter box is initialized with the default parameters. During subsequent power ups, it is initialized with the saved parameters.

Note: When the master detects the presence of the splitter box on the network, the parameters of the splitter box that are re-defined in the master's configuration tool are overwritten.

Updating Default Parameters

Saved parameters are only applied once the speed on the Advantys splitter box has been detected.

Saving and Resetting Parameters

The back-up of parameters is performed by writing a signature to the object 1010H (see *Object 1010H: Store Parameters, p. 160*) These parameters will be used during the next start-ups.

Saved parameters are reset with the default values by writing a signature in the object 1010H (see *Object 1011H: Restore Default Parameters, p. 162*).

Recommendations to Avoid Data Losses

While writing or deleting saved parameters, the slave no longer processes communications received via the CANopen bus. During this operation, none of the messages transmitted to the slave are taken into account (this includes SDO or Node-Guarding messages).

In order to avoid equipment damage or injury to personnel as well as any losses of data, it is not advisable to initiate parameter saves or restitution when the equipment is in "Operational" mode.

⚠ WARNING

RISK OF UNINTENDED DEVICE OPERATION

- Do not change the device configuration when it is in “Operational” state.
- To reconfigure the device, put it in the “Pre-Operational” state first and confirm it has entered this state before attempting reconfiguration.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

List of Saved Parameters

Application of Saved Parameters

In automatic speed detection mode, the saved parameters are only applied after speed detection.

Communication Profile Objects

The objects that are saved or reused on start-up are as follows:

- 1005H : COB-ID Sync Message
- 1006H : Communication Cycle Period
- 100CH : Guard Time
- 100DH : Life Time Factor
- 1014H : COB-ID Emergency Message (EMCY)
- 1016H : Consumer Heartbeat Time
- 1017H : Producer Heartbeat Time
- 1400H...1404H : 1st to 5th Receive PDO Communication Parameter
- 1600H...1604H : 1st to 5th Receive PDO Mapping Parameter
- 1800H...1804H : 1st to 5th Transmit PDO Communication Parameter
- 1A00H...1A04H : 1st to 5th Transmit PDO Mapping Parameter

Configuration Objects of Discrete splitter boxes

The discrete I/Os configuration objects are as follows:

- 2000H : Input/Diag Parameter
- 2001H : Input/Output Parameter
- 6102H : Polarity Input 16 Bits
- 6103H : Filter Mask Input 16 Bits
- 6200H : Write Outputs 8 Bits
- 6302H : Polarity Output 16 Bits
- 6306H : Fallback Mode Output 16 Bits
- 6307H : Fallback Value Output 16 Bits

⚠ WARNING

RISK OF UNINTENDED EQUIPMENT OPERATION

Check the contents of object 6200H before switching the product into "Operational" state. Output write objects are saved. Following power up, the switch to "Operational" state will apply to the saved output values.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Configuration Objects of Analog splitter boxes

The analog I/Os configuration objects are as follows:

- 2100H : Analog Input Type
- 2200H : Analog Output Type
- 6411H : Write Analog Output 16 Bits
- 6422H : Analog Input Interrupt Source
- 6423H : Analog Input Global Interrupt Enable
- 6426H : Analog Input Delta Value
- 6443H : Analog Output Fallback Mode
- 6444H : Analog Output Fallback Value

⚠ WARNING

RISK OF UNINTENDED EQUIPMENT OPERATION

Check the contents of object 6411H before switching the product into "Operational" state. Output write objects are saved. Following power up, the switch to "Operational" state will apply to the saved output values.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Application-Specific Functions

6

At a Glance

Introduction

Depending on its version, the FTM splitter box offers discrete input, output and diagnostics channels and discrete input or output for configurable channels. This following chapter describes the operating modes for these different channels.

What's in this Chapter?

This chapter contains the following topics:

List of Objects

List of Communication Objects

The communication objects are listed in the following table:

Object
Object 1000H: Device Type, p. 148
Object 1001H: Error Register, p. 149
Object 1002H: Manufacturer Status Register, p. 150
Object 1003H: Pre-defined Error Field (PEF), p. 151
Object 1005H: COB-ID SYNC Message, p. 154
Object 1006H: Communication Cycle Period, p. 155
Object 1008H: Manufacturer Device Name, p. 156
Object 100AH: Manufacturer Software Version (MSV), p. 157
Object 100CH: Guard Time, p. 158
Object 100DH: Life Time Factor, p. 159
Object 1010H: Store Parameters, p. 160
Object 1011H: Restore Default Parameters, p. 162
Object 1014H: COB-ID Emergency Message (EMCY), p. 163
Object 1016H: Consumer Heartbeat Time, p. 164
Object 1017H: Producer Heartbeat Time, p. 165
Object 1018H: Identity Object, p. 166
Object 1027H: Module List, p. 167
Object 1200H: Server SDO Parameter, p. 168
Object 1400H: 1st Receive PDO Communication Parameter, p. 169
Object 1401H: 2nd Receive PDO Communication Parameter, p. 170
Object 1402H: 3rd Receive PDO Communication Parameter, p. 171
Object 1403H: 4th Receive PDO Communication Parameter, p. 172
Object 1404H: 5th Receive PDO Communication Parameter, p. 173
Object 1600H: 1st Receive PDO Mapping Parameter, p. 174
Object 1601H: 2nd Receive PDO Mapping Parameter, p. 175
Object 1602H: 3rd Receive PDO Mapping Parameter, p. 176
Object 1603H: 4th Receive PDO Mapping Parameter, p. 177
Object 1604H: 5th Receive PDO Mapping Parameter, p. 178
Object 1800H: 1st Transmit PDO Communication Parameter, p. 179
Object 1801H: 2nd Transmit PDO Communication Parameter, p. 182

Object
Object 1802H: 3rd Transmit PDO Communication Parameter, p. 185
Object 1803H: 4th Transmit PDO Communication Parameter, p. 188
Object 1804H: 5th Transmit PDO Communication Parameter, p. 191
Object 1A00H: 1st Transmit PDO Mapping Parameter, p. 194
Object 1A01H: 2nd Transmit PDO Mapping Parameter, p. 195
Object 1A02H: 3rd Transmit PDO Mapping Parameter, p. 196
Object 1A03H: 4th Transmit PDO Mapping Parameter, p. 197
Object 1A04H: 5th Transmit PDO Mapping Parameter, p. 198

List of Manufacturer-specific Profile Objects

The manufacturer-specific profile objects are listed in the following table:

Object
Object 2000H: Input / Diag Parameter, p. 200
Object 2001H: Input/Output Parameter, p. 201
Object 2100H: Analog Input Type, p. 202
Object 2200H: Analog Output Type, p. 203
Object 3000H: Module Specific Diagnostic, p. 204
Object 3002H: Extension Module Revision Number, p. 205
Object 3003H: Extension Module Type, p. 206

List of Device Profile Objects

The device profile objects are listed in the following table:

Object
Object 6000H: Read Input 8 Bits, p. 208
Object 6102H: Polarity Inputs 16 Bits, p. 209
Object 6103H: Filter Mask Input 16 Bits, p. 210
Object 6200H: Write Outputs 8 Bits, p. 211
Object 6302H: Polarity Outputs 16 Bits, p. 212
Object 6306H:Fallback Mode Output 16 Bits, p. 213
Object 6307H: Fallback Value Output 16 Bits, p. 214
Object 6401H: Read Analog Input 16 Bits, p. 215
Object 6411H: Write Analog Output 16 Bits, p. 216
Object 6422H: Analog Input Interrupt Source, p. 217
Object 6423H: Analog Input Global Interrupt Enable, p. 218
Object 6426H: Analog Input Delta Value, p. 219
Object 6443H: Analog Output Fallback Mode, p. 220
Object 6444H: Analog Output Fallback Value , p. 221

Description of the discrete I/Os

Digital Inputs

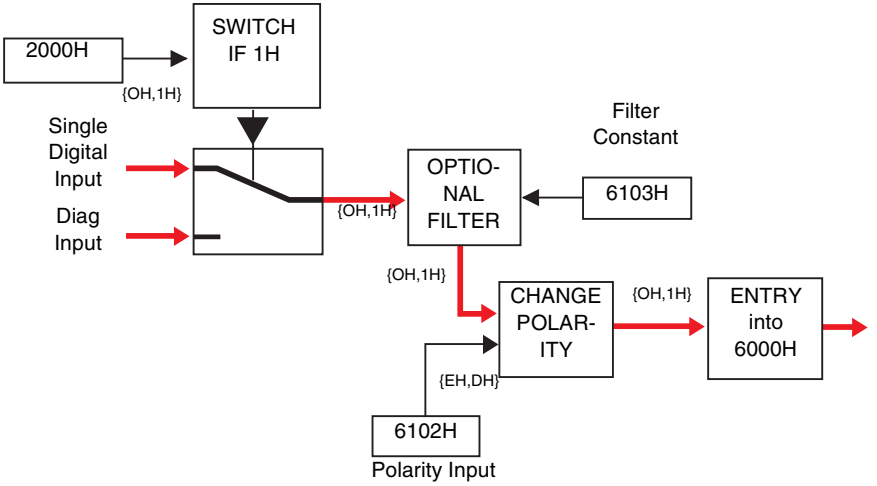
Input reading made per byte. Each input byte is contained in the sub-index of object 6000H.

For each input, the following parameters may be modified:

- Polarity (object 6102H),
- Filtering constant (object 6103H).

The 2000H object is used to configure inputs 10 to 17 as a discrete input or a diagnostics input.

The status read on inputs is defined as follows:



Discrete Outputs

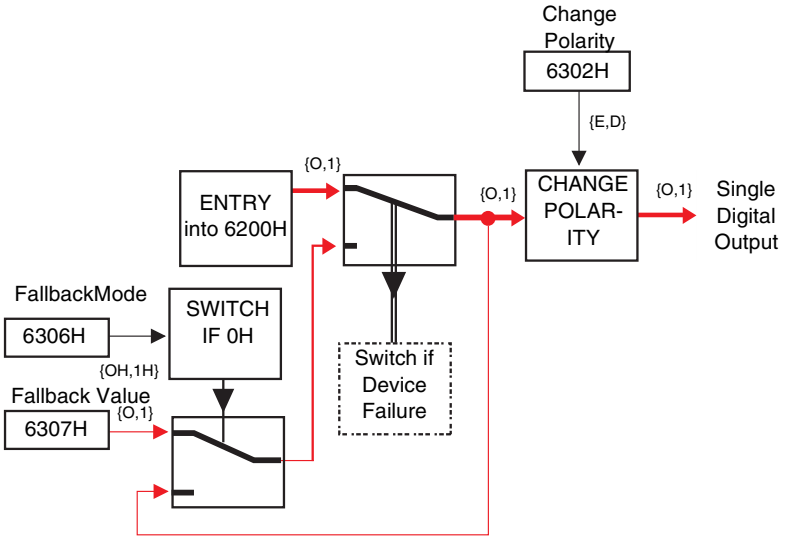
Discrete outputs operate using a one byte command written in the corresponding sub-index of object 6200H.

For each output, the following parameters may be modified:

- Polarity (object 6302H),
- Fallback mode (object 6306H),
- Fallback value (object 6307H).

In the event of an error (loss of communication with the master for example), the fallback mode is applied.

The state of the outputs is defined according to the configuration registers and equipment mode (according to the DS 401 device profile). See below:



Note: For further information on the list of the various objects, see the "*The Object Dictionary, p. 141*" chapter.

Description of Configurable Discrete I/Os

Channel Configured for Discrete Input

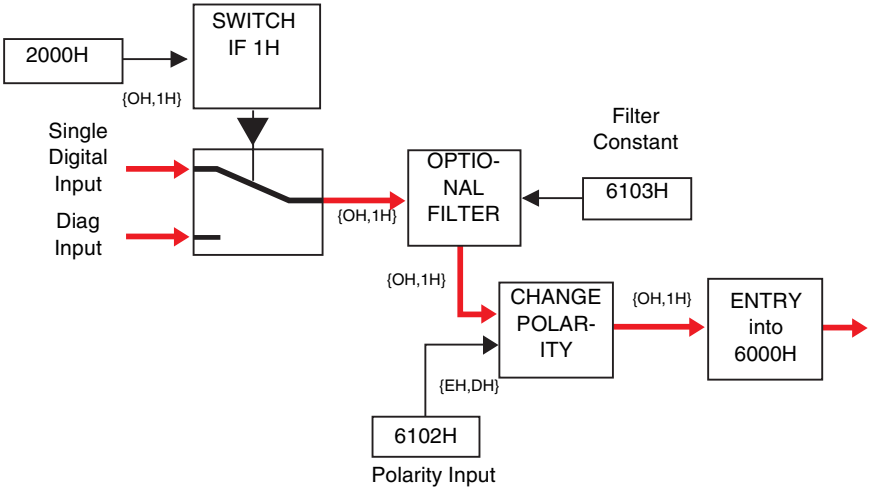
Input reading made per byte. Each input byte is contained in the sub-index of object 6000H.

For each input, the following parameters may be modified:

- Polarity (object 6102H),
- Filtering constant (object 6103H).

The 2000H object is used to configure inputs 10 to 17 as a discrete input or a diagnostics input.

The status read on inputs is defined as follows:



Channel Configured for Discrete Output

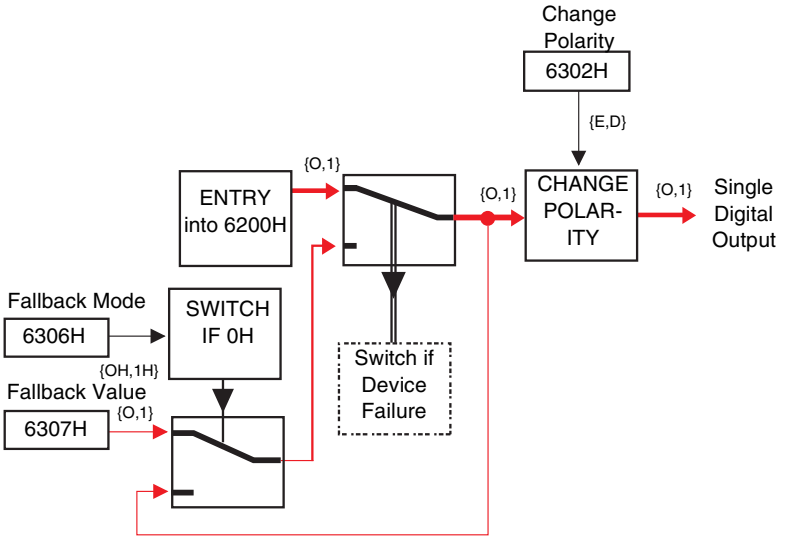
Writing outputs made per byte. Each output byte is written in the sub-index of object 6200H.

For each output, the following parameters may be modified:

- Polarity (object 6302H),
- Fallback mode (object 6306H),
- Fallback mode (object 6307H).

In the event of an error (loss of communication with the master for example), the fallback mode is applied.

The status applied to the output is defined as follows (according to the DS 401 device profile):



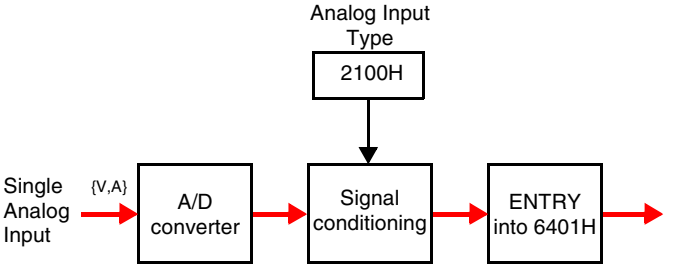
Note: For further information on the lists of the various objects, see the "*The Object Dictionary, p. 141*" chapter.

Description of Analog I/Os

Analog inputs

Analog inputs are read by 16 bit words. The value of each channel is contained in a sub-index of object 6401H.

The status read on inputs is defined as follows:



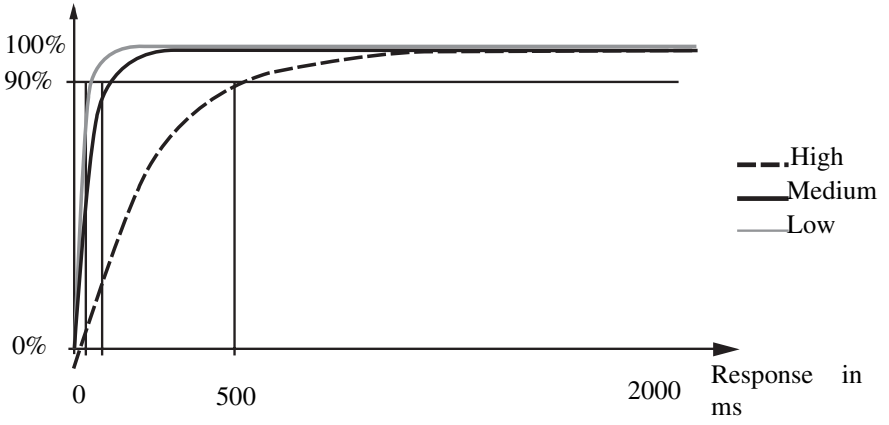
Note: For further information on the list of the various objects, see the "*The Object Dictionary, p. 141*" chapter.

Smoothing the Input Value

The analog signal can be pre-filtered in the splitter box (object 2100H). For example, the user may want to reduce temporary measurement variations.

The measurement time is 2 ms per channel. The total cycle time is the result of the measurement time for each channel + 2.5 ms.

The following diagram shows the behavior of the splitter box in relation to the response time on an active channel.



Use of the Delta Value (object 6426H)

The Delta value is used to define a deadband, within which any modification of the input signal value is not indicated. This is used to avoid a bus overload if data is transmitted about a change in value.

The Delta value is expressed as a number of input points on a gross measurement scale. (See tables below for a view of the scales according to configuration)

Example

If the final measurement value was 1000 points. By adjusting the Delta value to 100, a new measurement value can only be sent where this is less than 900 or greater than 1100.

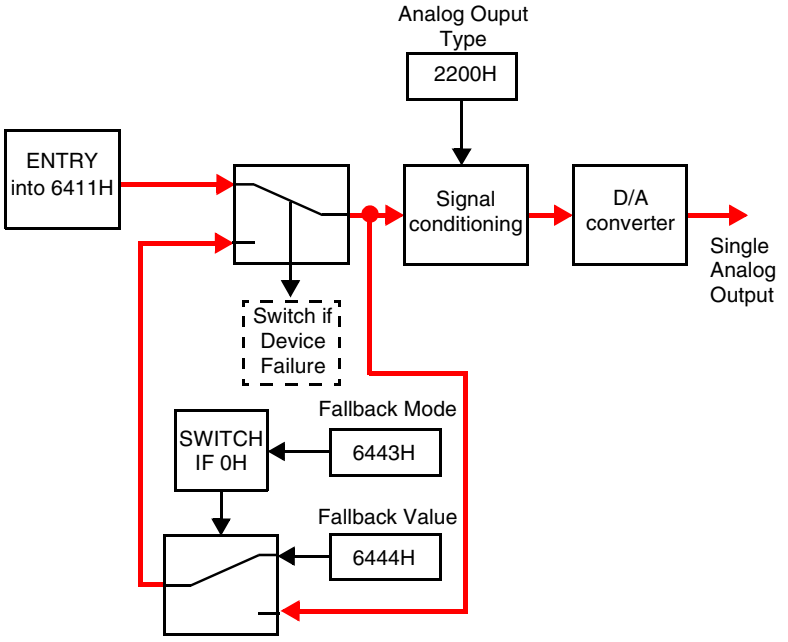
Note: If data is transmitted about a change in values, the user must set the object "Analog Input Global Interrupt Enable" (6423H) to 1.

Analog Outputs

Outputs are written using 16 bit words. Each output byte is contained in the sub-index of object 6411H.

In the event of an error (loss of communication with the master for example), the fallback mode is applied.

The status applied to the output is defined as follows (according to the DS 401 device profile):



Note: For further information on the list of the various objects, see the "*The Object Dictionary, p. 141*" chapter.

Measurement Ranges and Scales

FTM 1AE04C12T range 0...10 VDC Measurement range of analog input (15 bits resolution):

Measurement range	Binary value	Hexadecimal value	Decimal value	Zone	Diagnostics
> 10 VDC	0111 1111 1111 1111	7FFF	32 767	Greater than	yes
10 VDC	0111 1111 1111 1111	7FFF	32 767	Nominal range	-
5 VDC	0011 1111 1111 1111	3FFF	16 383	Nominal range	-
0.305 mVDC	0000 0000 0000 0001	0001	1	Nominal range	-
0 VDC	0000 0000 0000 0000	0000	0	Nominal range	-
< 0 VDC	0000 0000 0000 0000	0000	0	Less than	-

FTM 1AE04C12T range +/-10 VDC Measurement range of analog input (resolution : 15 bits + 1 sign bit):

Measurement range	Binary value	Hexadecimal value	Decimal value	Zone	Diagnostics
> 10 VDC	0111 1111 1111 1111	7FFF	32 767	Greater than	yes
10 VDC	0111 1111 1111 1111	7FFF	32 767	Nominal range	-
5 VDC	0011 1111 1111 1111	3FFF	16 383	Nominal range	-
0.305 mV	0000 0000 0000 0001	0001	1	Nominal range	-
0 VDC	0000 0000 0000 0000	0000	0	Nominal range	-
-0.305 mV	1111 1111 1111 1111	FFFF	-1	Nominal range	-
-5 VDC	1100 0000 0000 0001	C000	-16 383	Nominal range	-
-10 VDC	1000 0000 0000 0000	8000	-32 767	Nominal range	-
<-10 VDC	1000 0000 0000 0000	8000	-32 767	Less than	yes

FTM 1AE04C12C range 0...20 mA Measurement range of analog input (15 bits resolution):

Measurement range	Binary value	Hexadecimal value	Decimal value	Zone	Diagnostics
> 20 mA	0111 1111 1111 1111	7FFF	32 767	Greater than	yes
20mA	0111 1111 1111 1111	7FFF	32 767	Nominal range	-
10 mA	0011 1111 1111 1111	3FFF	16 383	Nominal range	-
4 mA	0001 1001 1001 1001	1999	6553	Nominal range	-
0 mA	0000 0000 0000 0000	0000	0	Nominal range	-
< 0 mA	0000 0000 0000 0000	0000	0	Less than	-

FTM 1AE04C12C range 4...20 mA Measurement range of analog input (15 bits resolution):

Measurement range	Binary value	Hexadecimal value	Decimal value	Zone	Diagnostics
> 20 mA	0111 1111 1111 1111	7FFF	32 767	Greater than	yes
20mA	0111 1111 1111 1111	7FFF	32 767	Nominal range	-
10 mA	0010 1111 1111 1010	2FFA	16 383	Nominal range	-
4 mA	0000 0000 0000 0000	0000	0	Nominal range	-
< 4 mA	0000 0000 0000 0000	0000	0	Less than	Break in cable < 2 mA and/ or Overrun of lower threshold < 4 mA

FTM 1AS04C12T range 0...10 VDC Measurement range of analog output (11 bits resolution):

Output range	Binary value	Hexadecimal value	Decimal value	Zone
10 VDC	0111 1111 1111 xxxx	7FFx	32 752...3 2767	Nominal range
5 VDC	0011 1111 1111 xxxx	3FFx	16 368...16 383	Nominal range
0.305 mVDC	0000 0000 0000 xxxx	000x	0...15	Nominal range
0 VDC	0000 0000 0000 xxxx	000x	0...15	Nominal range

FTM 1AS04C12T range +/-10 VDC Measurement range of analog output (resolution: 11 bits + 1 sign bit):

Output range	Binary value	Hexadecimal value	Decimal value	Zone
10 VDC	0111 1111 1111 xxxx	7FFx	32 752...32 767	Nominal range
5 VDC	0011 1111 1111 xxxx	3FFx	16 368...16 383	Nominal range
0.305 mV	0000 0000 0000 xxxx	000x	1...15	Nominal range
0 VDC	0000 0000 0000 xxxx	000x	0	Nominal range
-0.305 mVDC	1111 1111 1111 xxxx	FFFx	-1...-15	Nominal range
-5 VDC	1100 0000 0000 xxxx	C00x	-16 383...-16 368	Nominal range
-10 VDC	1000 0000 0000 xxxx	800x	-32 767...-32 752	Nominal range

FTM 1AS04C12C range 0...20 mA Measurement range of analog output (11 bits resolution):

Output range	Binary value	Hexadecimal value	Decimal value	Zone
20 mA	0111 1111 1111 xxxx	7FFx	32 752...32 767	Nominal range
10 mA	0011 1111 1111 xxxx	3FFx	16 368...16 383	Nominal range
4 mA	0001 1001 1001 xxxx	199x	6544...6553	Nominal range
0 mA	0000 0000 0000 xxxx	000x	0...15	Nominal range

FTM 1AS04C12C range 0...20 mA Measurement range of analog output (11 bits resolution):

Output range	Binary value	Hexadecimal value	Decimal value	Zone
20 mA	0111 1111 1111 xxxx	7FFF	32 767	Nominal range
10 mA	0010 1111 1111 xxxx	2FFx	12 272...12 287	Nominal range
4 mA	0000 0000 0000 xxxx	000x	0...15	Nominal range

Note: The sub-index of write analog output for object 6411H (Write Analog Output 16 bits) are in 16-bit format and the resolution of A/N convertors is 12 bits, which causes non-significant values to appear.

Software Installation

7

At a Glance

Introduction

This chapter deals with Advantys FTM CANopen splitter box software installation.

What's in this Chapter?

This chapter contains the following sections:

7.1 Introduction to Software Tools

Introduction

General

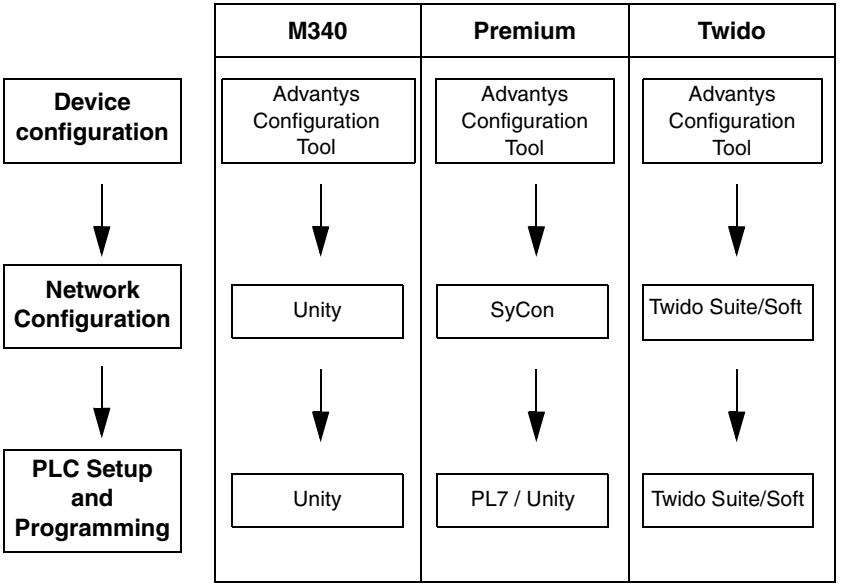
The products in the Advantys range must be configured to be able to operate correctly on the network. There are three stages in the configuration process:

- Configuration of the Advantys devices and the desired parameters.
- Configuration of the network (master and slaves).
- PLC setup and programming: I/O, startup of the network and subsequent use.

Note: For more information, please consult the appropriate documentation for the other network devices that may be required, the Advantys Configuration Tool online help (FTX ES 0•), the PLC manual etc.

Software Tools

The software to be used depends on the PLC software workshop. Certain PLC software workshops can configure the network. The following diagram shows the software to be used for three Telemecanique PLC software workshops:



Note: With Twido Suite, Advantys Configuration Tool is run directly by Twido Suite to create or modify an island.

Advantys Device Configuration

The first phase is accomplished by using the Advantys Configuration Tool (FTX ES 0•). This tool is used to to set the parameters and the functions of the inputs/outputs and to generate the configuration files and image files (.dib) required to integrate each device into the master.

Configuration Files

There are two types of configuration file:

- EDS (Electronic Data Sheet) files, which define the structure of the data available in a splitter box (see the object dictionary).
- DCF (Device Configuration File) files which, in addition to the information contained in an EDS file, also contain settings data (Cf. CiA CAN standard DS 306).

Note: For further information on configuration file creation, please refer to the user manual or to the Advantys Configuration Tool online help.

Network Configuration

This phase may be carried out by a specific software application (e.g. SyCon) or by certain PLC software workshops (e.g. Unity, Twido Suite...). This phase involves integrating all devices into the network, and defining the network (master configuration) so as to create a functional network.

PLC Setup and Programming

This phase is carried out by the operator, via the PLC software workshop.

Software Installation

Before installing the software, please refer to the relevant manuals.

7.2 Product Configuration

At A Glance

Introduction

This section describes the tools and operating modes that generate the EDSs and DCFs of the Advantys range of devices using the Advantys Configuration Tool (FTX ES 0•).

The software generates one file per island. An island represents a node on the network with a separate network address. An island can correspond to:

- An OTB module (with or without expansion modules),
- An FTB splitter box,
- A modular FTM splitter (module with or without splitters).

What's in this Section?

This section contains the following topics:

Characteristics of an EDS File

Description

The EDS file describes all configurable objects for CANopen products. These configurable objects are used to identify the product and specify the appropriate behavior. The parameters of an EDS file contain all the important information relating to the product. For example:

- The product type
- The manufacturer
- The identification of the vendor
- The item number
- The software version
- The hardware version
- The details of all the configurable objects
- etc.

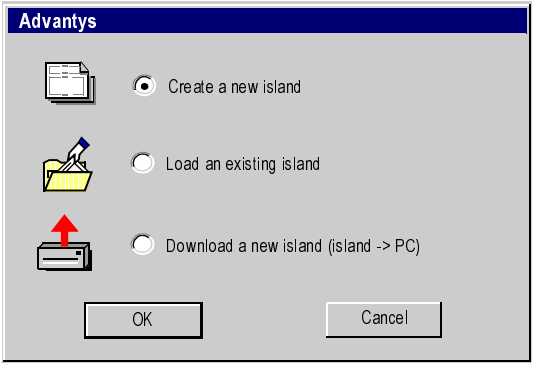
Each EDS file is specific to a product type and cannot be re-used on other products as this will result in the incorrect I/O configuration. It is up to the user to make sure that the correct EDS file is used.

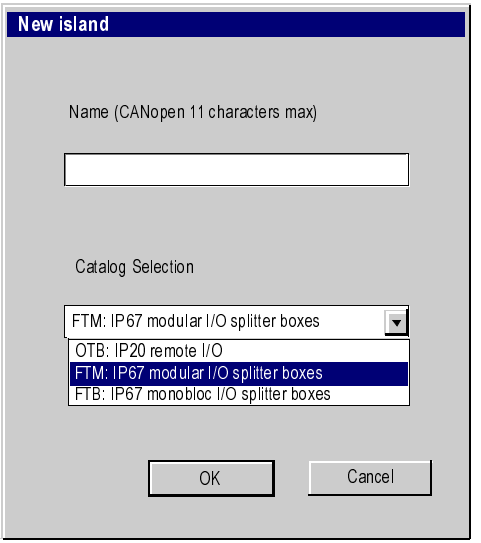
Creating a New EDS and DCF Configuration File

Introduction

Once you have installed and registered the Advantys Configuration Tool (ACT), the process of creating configuration (*.EDS / *.DCF) files for the island can begin.

Creating a New EDS and DCF Configuration File

Step	Action
1	Launch the Advantys Configuration Tool software. A window appears:  • Select **Create new island** • Click on the **OK**button.

Step	Action
2	The **New island** window appears:  The creation of an island must be in line with the physical configuration of your installation: ● Enter the name of the island in the field**Name**. The name of the island must correspond to the name of the EDS configuration file. ● Select the catalog in the **Catalog selection** drop-down menu. ● Confirm your selection by clicking on the **OK** button
3	**Building the Island** A browser window appears. A representative model of the island can be built in this window. At this point, this is an image of an empty 35mm *(1.37in)* DIN rail. The catalog browser contains all the references of the catalog selected. Building the island is a "drag and drop" operation: ● Click on the reference in the catalog browser window and, while holding down the left mouse button, drag the reference over to the DIN rail and drop it (release the mouse button).

Step	Action
4	**Island Configuration** Once the island has been built, you can set its parameters. The parameters you need to define will depend on the I/O functions you wish to use. The islands are configured in the configuration window: ● Open the configuration window by double clicking on the island (or by selecting the island and then the **Island/Module Editor** menu. ● Modify the required parameter(s). ● Click **OK** to save the changes and close the configuration window. **Notes:** The values given in the configuration window define the behavior of the island. PDOs are configured in such a way as to transport the island process data. The list of data contained in the PDOs is visible in the **I/O Assignment** tab of the configuration window.
5	**Saving the Island and Generating an EDS or DCF Configuration File** ● Select the **Save** command from the **File** menu. The `*.ISL` island file is saved. ● A **Generate** window appears. Select the file type to generate (*.EDS/*.DCF/Symbol table) and the configuration used (Twido/Premium/M340/Other). Click **OK** to generate and save the configuration files. **Notes:** The data in the symbol table can be modified only for M340.

7.3 Network Configuration

Setting the Network Parameters

Description

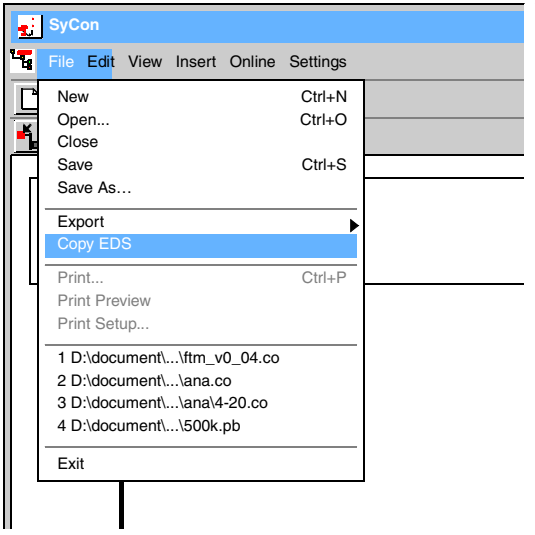
The configuration tool is used to draw diagrams of networks using a graphic representation of the network nodes. It is then used to generate the complete configuration of the network that has been drawn.

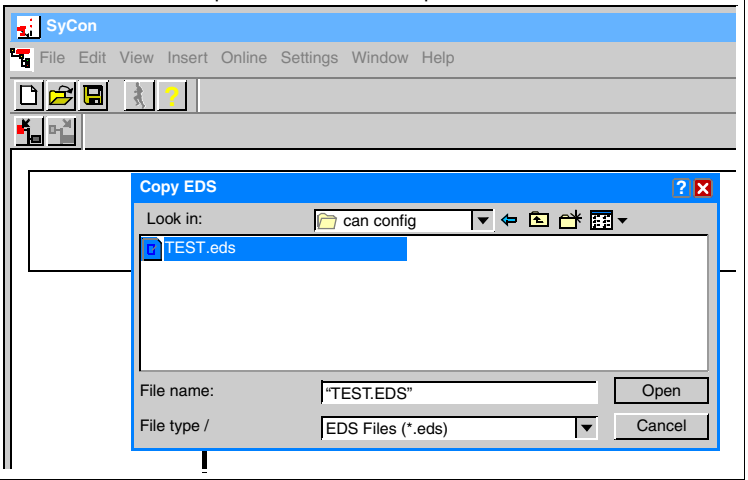
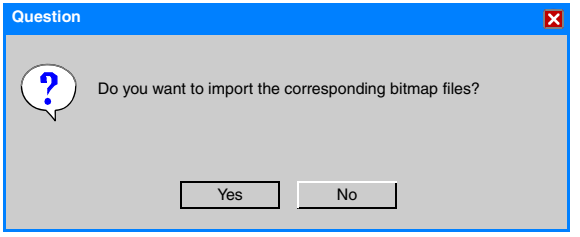
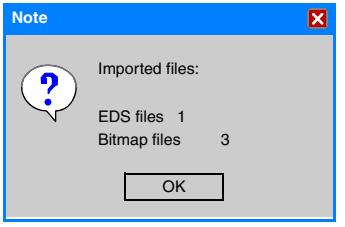
It provides access to the various configuration parameters and communication parameters by PDO.

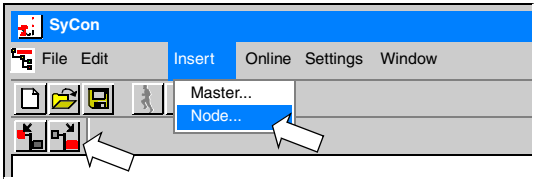
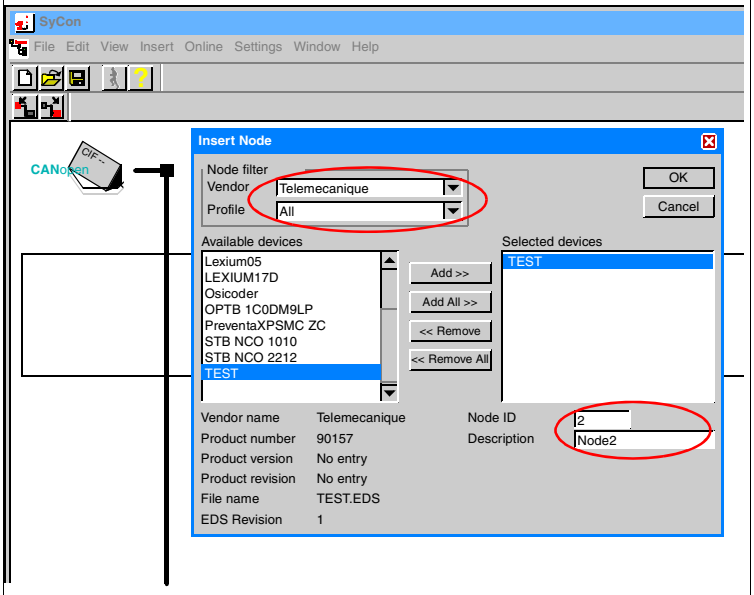
Below is an example of how to use the SyCon configuration tool:

Method

Within the PL7 programming software or Unity, launch the SyCon network tool and follow the steps below:

Steps	Actions
1	Open a CANopen type file.
2	Click on "File" and select "Copy EDS". 

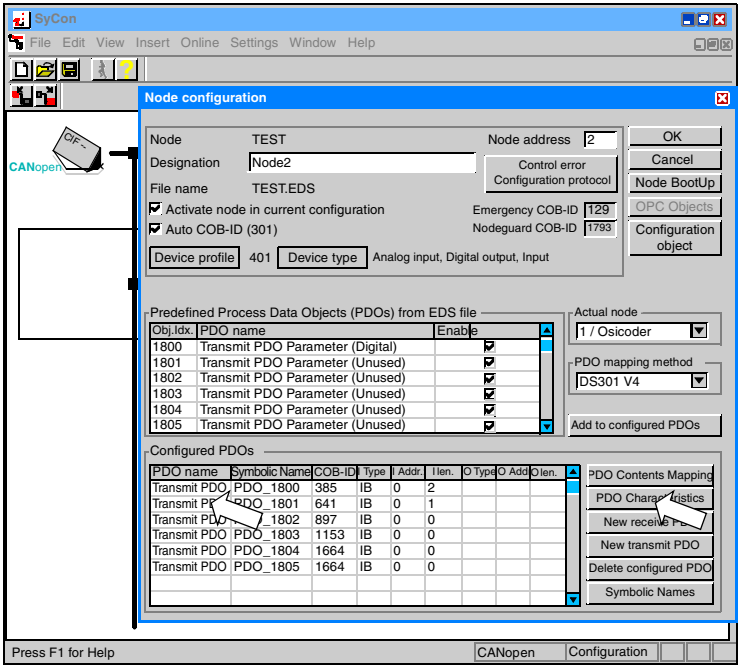
Steps	Actions
3	Select the file to be imported and click on "Open": 
4	Click on "Yes" to import the 3 associated image files. 
5	If the image files are in the same directory as the EDS file, they are found automatically:  Click "OK".

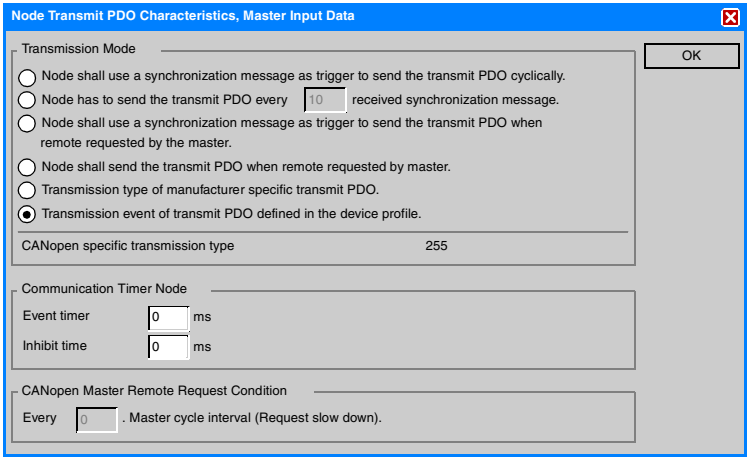
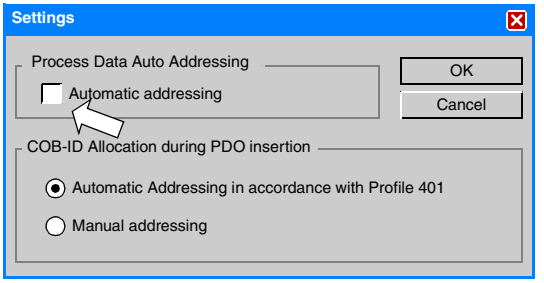
Steps	Actions
6	Click on "Insert" and select "Node" or click on the associated button. 
7	Select the devices to be inserted in the network, enter the node address (given on the product) and the node description, and click OK:  Note: The name given in the list is the "comment associated with communication block" defined with CANConfig.

Configuring the PDOs

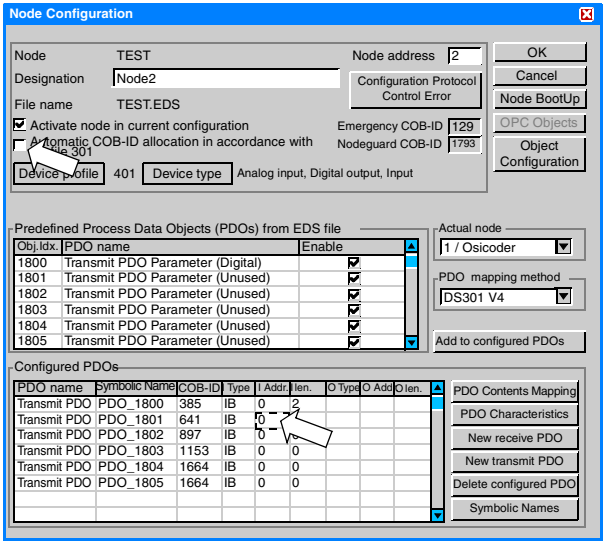
Follow the steps below:

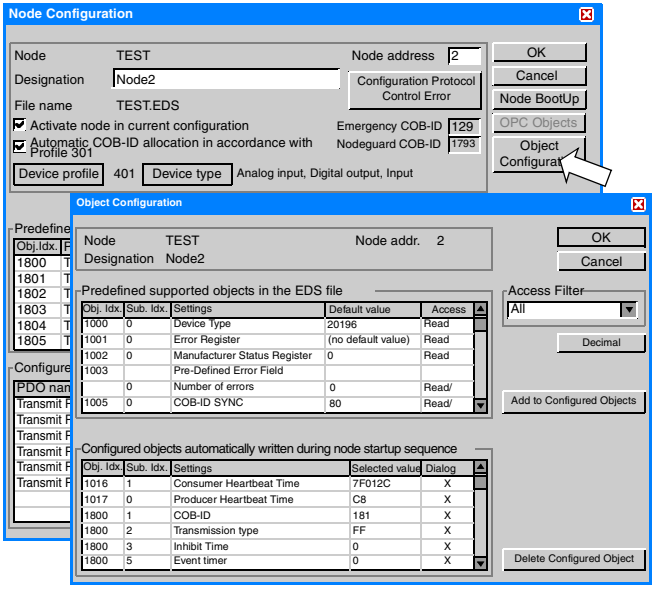
Step	Action
1	Double-click on the image of the island to be configured. The configuration window appears.
2	Select a configured PDO and click on "PDO characteristics":



Step	Action
3	Select the required transmission mode and click OK: 
4	If you want to define the addresses of the activated PDOs manually: ● Select the master, ● Click on "Settings" and select "Global settings", ● Deselect "Automatic addressing" in the "Process Data Auto Addressing" area, ● Click OK. Illustration  Otherwise, go directly to step 6.

Step	Action
5	Enter the required values in the "I Adrr" and "O Addr" boxes opposite the activated PDO.



Step	Action
6	Click on "Object Configuration":  This window is used to configure the default values of the configured objects that will be sent to the device the next time the node is powered up. For further information on the various objects see *The Object Dictionary, p. 141*
7	Select the objects to be sent to the device, click on "Add to Configured Objects" then click OK.
8	Select "File/Save": A *.CO configuration file is created, which contains the complete network architecture and the initial configuration of each node. This file is used by PLC programming software (e.g. PL7, Unity, etc.).

7.4 PLC Programming

Presentation

Introduction

This chapter describes how to integrate the CANopen network configuration file and configuring under PL7.

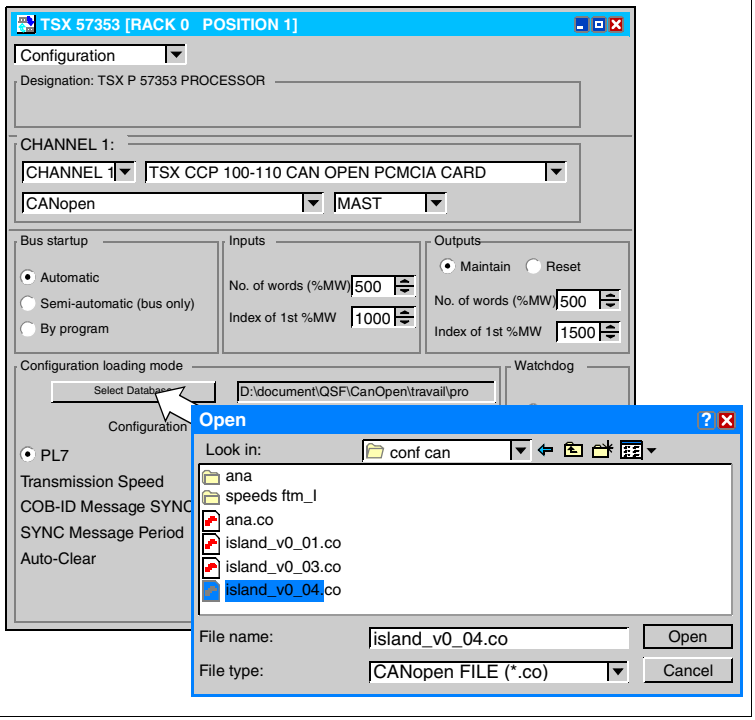
What's in this Section?

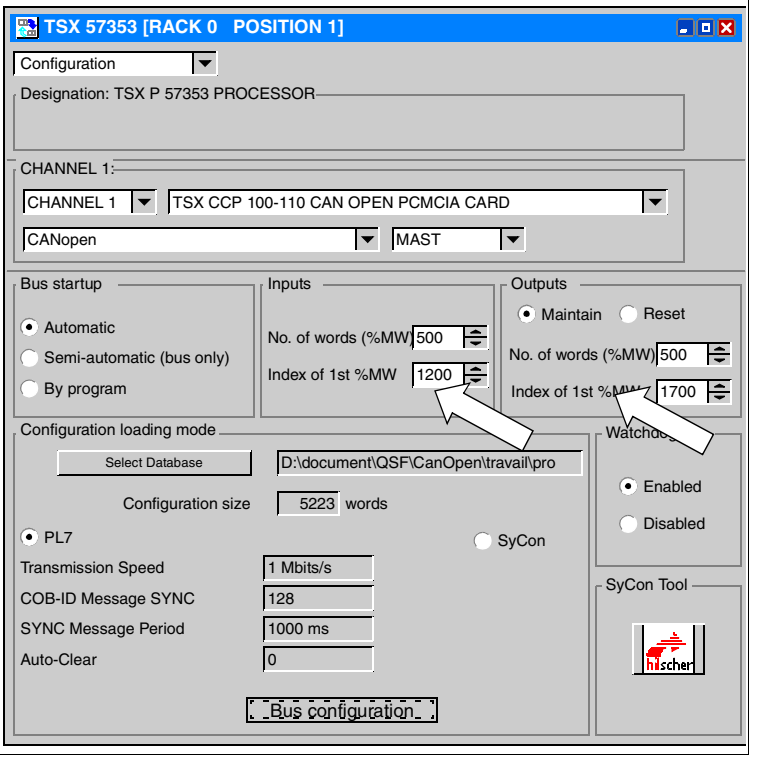
This section contains the following topics:

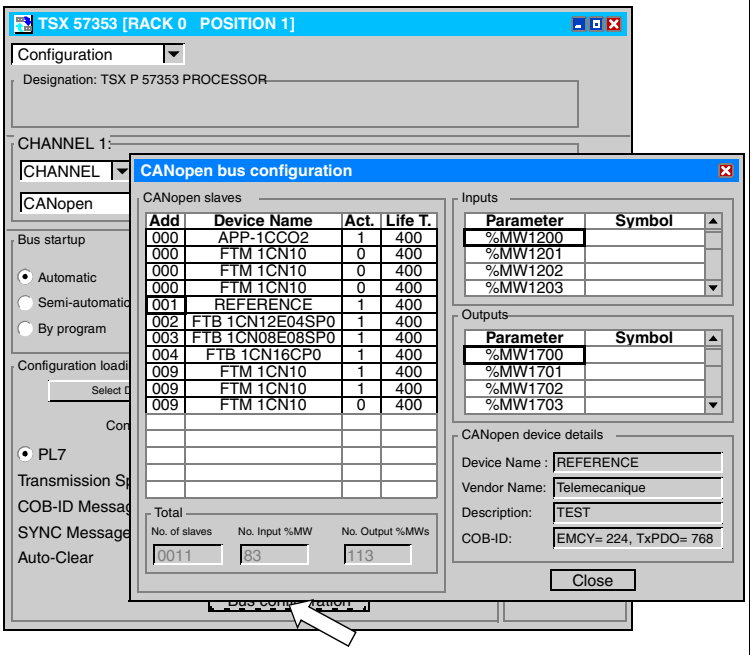
Integration and Use under PL7

Configuration

Follow the steps below:

Steps	Actions
1	In the master configuration window, select the network configuration file generated with SYCON: 

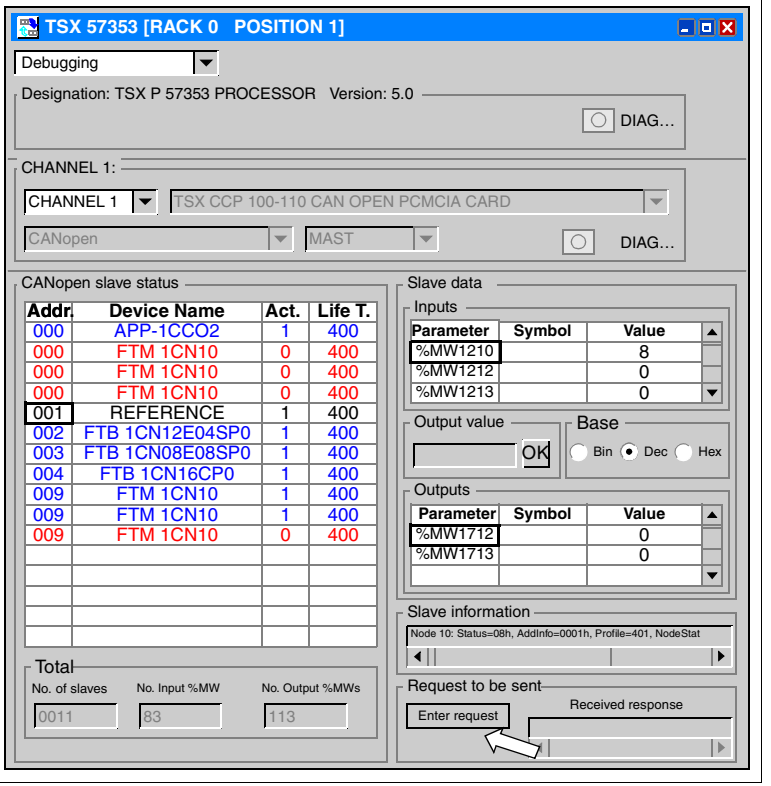
Steps	Actions
2	Complete the fields of the "Input" boxes (input data exchange area) and "Output" boxes (output data exchange area): 

Steps	Actions
3	Click on the "Bus Configuration" button:  The bus configuration window is used to display the exact address of the data associated with the devices. The start address of each PDO is defined by the start address of the exchange area configured using PL7, to which the PDO offset defined using SyCon is added.
4	Execute the required SDO requests (either from the debug screen, or with a program).

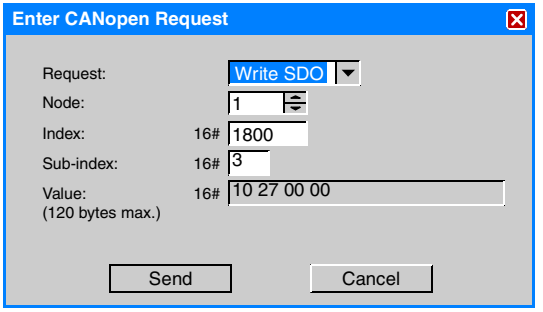
SDO Request from the Debug Screen

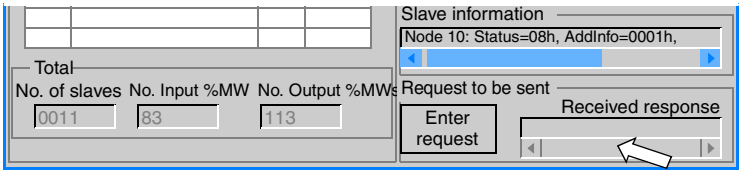
Follow the steps below:

Step	Action
1	Click on the "Enter request" button in the bottom-right of the debug screen:



Step	Action

2	• Complete the fields:
	  • Request: "Write SDO" or "Read SDO"
	  • Node: address of the device on the CANopen network
	  • Index: index of the object to read or write
	  • Sub-index: sub-index of the object to read or write
	  • Value: entry area for the data to be sent, for write only
	• Click "Send".
	
	Here is an example of how to configure the Inhibit Time to 1000 ms:
	 
	
	The value "10 27 00 00" corresponds to the number 2710 in hexadecimals, which is 1000 ms (see *Inhibit Time and Event Timer, p. 77*).

3	After a "Read SDO", read the value given in the "Received response" area in the bottom-right of the debug screen: 

Examples of SDO Requests

Programmed SDO Request: Example 1

This example gives the program for reading object 1000H. After a request is made, the data obtained is read in the table Diag0:120 (defined below).

Variables used and parameters of the function

Variable	Type	Description
Read_sdo	Boolean	Request launch bit.
Index	Word	Index of the object to poll (LSB of the double word "Index_dw").
Sub-index	Word	Sub-index of the object to poll (MSB of the double word "Index_dw").
Slave_add	Word	Address of the slave to poll.
Diag0:120	Word table	Data exchange area.
Status0:4	Word table	Control and exchange status words.
ADR#y.SYS	Immediate value	Master board address.
'SDO'	Character string	Type of SDO object (SDO always in upper case).
Index_dw	Double word	MSB = sub-index. LSB = index.
Node_Id	Word	Word or value identifying the destination device on the CANopen bus.

Program

```
Slave_add:=2 (*node at address 2 on the CANopen network*)
Index:=16#1000; (*index 1000H*)
Sub_index:=0; (*sub-index 0*)
IF Read_sdo THEN
   (*clear control*)
   Read_sdo:=FALSE;
   (*Parameter update*)
   Node_Id:=Slave_add; (*Slave address*)
   Diag0:120:=16#FFFF; (*Clear diagnostics receive table*)
   Status2:=0; (*Clear exchange report*)
   Status3:=6; (*Time-out*)
   (*request*)
   READ_VAR(ADR#y.1.SYS,'SDO', _
   Index_dw,Node_Id,Diag0:120,Status1:4);
END_IF;
```

Programmed SDO Request: Example 2

This example shows the program for saving parameters with object 1010H. The data to be sent is contained in the table Diag0:4 (defined below).

Variables used and parameters of the function

Variable	Type	Description
Write_sdo	Boolean	Request launch bit.
Index	Word	Index of the object to poll (LSB of the double word "Index_dw").
Sub-index	Word	Sub-index of the object to poll (MSB of the double word "Index_dw").
Slave_add	Word	Address of the slave to poll.
Diag0:120	Word table	Data exchange area.
Status0:4	Word table	Control and exchange status words.
ADR#y.SYS	Immediate value	Master board address.
'SDO'	Character string	Type of SDO object (SDO always in upper case).
Index_dw	Double word	MSB = sub-index. LSB = index.
Node_Id	Word	Word or value identifying the destination device on the CANopen bus.

Program

```
Slave_add:=2 (*node at address 2 on the CANopen network*)
Index:=16#1010; (*index 1010H*)
Sub_index:=1; (*sub-index 1*)
Diag0:=16#6173; (*'as'*)
Diag0[1]:=16#6576; (*'ev'*)
IF write_sdo THEN
   (*clear control*)
   write_sdo:=FALSE;
   (*Parameter update*)
   Node_Id:=Slave_add; (*Slave address*)
   Status2:=0; (*Clear exchange report*)
   Status3:=6; (*Time-out*)
(*request*)
   WRITE_VAR(ADR#y.1.SYS,'SDO', _
   Index_dw,Node_Id,Diag0:4,Status1:4);
END_IF;
```

Diagnostics

8

At a Glance

Introduction

Diagnostics information simplifies installation and accelerates error searching.

This chapter provides the elements necessary for diagnostics by:

- LED display,
- CANopen object analysis

What's in this Chapter?

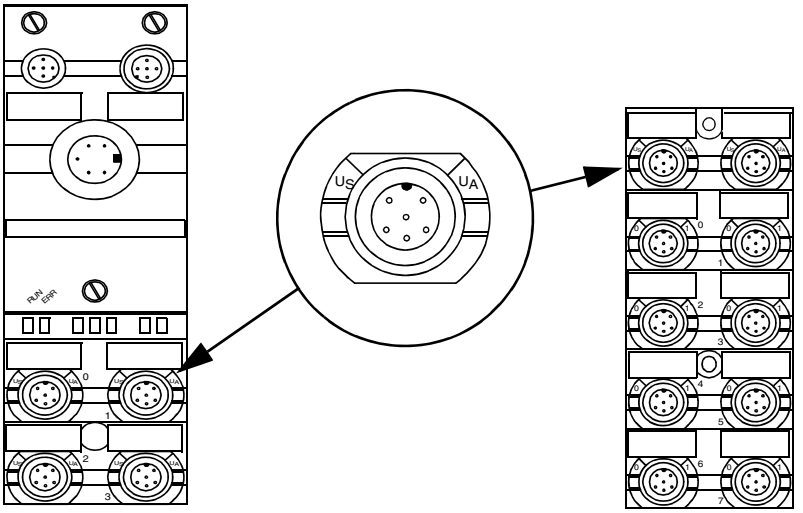
This chapter contains the following topics:

Power supply diagnostics

Description

The status of the power supply can be read from the internal bus connectors on the interface coupling device and on the splitter boxes (BUS IN).

Position of LEDs on the module and the splitter boxes:



LED	Meaning
LED U_A	Actuator power supply diagnostics LED:
LED U_S	Detector power supply diagnostics LED

Note: The color of the LED depends on the power supply, as described in the following tables:

Detector Power Supply Status

The status of the detector power supply is specified in the following table:

LED description	LED status	Description
U_S	Green	Correct (> 18 VDC)
U_S	Red	Under-voltage or short-circuit on detector power supply
U_S	Off	No power supply or power supplied to detectors < 12.5 VDC

Actuator Power Supply Status

The status of the actuator power supply is specified in the following table:

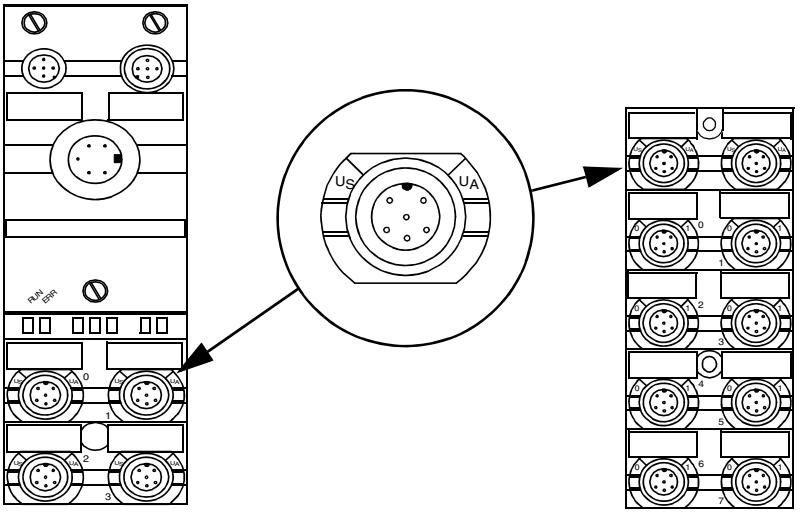
LED description	LED status	Description
U_A	Green	Correct (> 18 VDC)
U_A	Red	Under-voltage or short-circuit on actuator power supply
U_A	Off	No power supply or power supplied to actuators < 12.5 VDC

Note: The display for the power supply status of actuators external to the FTM 1DD16C12 is identical.

Internal Bus Diagnostics LEDs

Position of LEDs

The position of the U_S and U_A LEDs are specified in the following diagram:



Internal Bus Communication Status

The status of system communication at the module is specified in the following table:

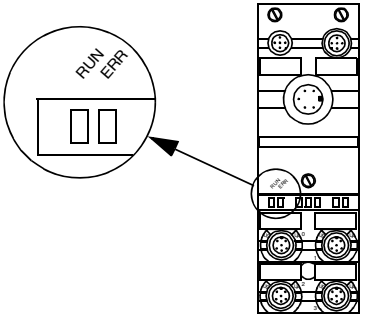
LED description	Display behavior	LED status
U_S	Permanently switched on	Data exchange
U_S	Flashing	No data exchange: communication has been interrupted on at least one branch.
U_S	Off	No communication: No splitter box is connected or the detector power supply has been cut off.

Field Bus Status Diagnostics LED

Description of the Display

The DRP 303-3 standard defines the functions of the RUN and ERR LEDs.

Position of RUN and ERR LEDs on the front panel:



ERR LED

BUS status	Description	LED status
Auto-Baud	Automatic recognition of transmission speed	Flashing
No error	Splitter box operating normally (OK)	Off
Warning limit reached	One of the internal error counters has reached the limit threshold (Error Frame)	1 flash
Error control event	Guarding (slave or master) or Heartbeat (user) error	2 flashes
Sync error	SYNC signal not received in the SYNC period	3 flashes
Bus is de-activated	CAN controller status: Bus off	Permanently switched on

RUN LED

BUS status	Description	LED status
Auto-Baud	Automatic recognition of transmission speed	Flash
STOP	Splitter box status: STOPPED	1 Flash
Pre-operational	Splitter box status: Pre-Operational	Flashing
Operational	Splitter box status: Operational	Permanently switched on

Diagnostics Characteristics of the Analog and Discrete splitter boxes

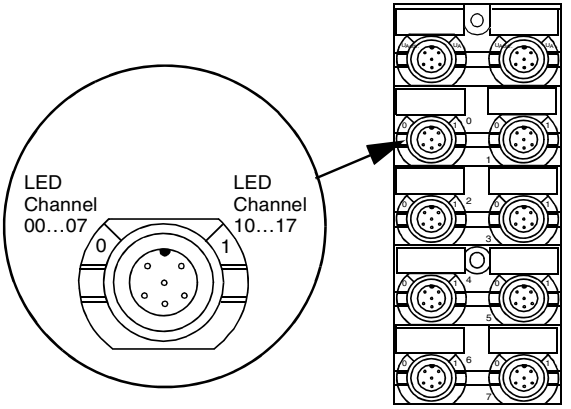
General Characteristics

Characteristic	Description
Bus and I/O under-voltage detection	< 18 VDC
Internal bus communication	By LED
Channel and splitter box short-circuit	By LED
Cable breakage	By LED

Discrete I/O Diagnostics LEDs

Position of LEDs

The position of the LEDs for each channel are specified in the following diagram:



LED Behavior

LED behavior according to settings and channel status:

Channel configuration	Input voltage	Logical value	LED status
Input closing function	0 VDC	0	Off
	24 VDC	1	Yellow
	Channel error	-	Red
Input opening function	0 VDC	1	Off
	24 VDC	0	Yellow
	Channel error	-	Red
Input diagnostics	0 VDC	1	Red
	24 VDC	0	Off
Output	0 VDC	0	Off
	24 VDC	1	Yellow
	Channel error	-	Red

Analog I/O Diagnostics LEDs

LED Behavior according to Settings and Channel Status

The LED behavior according to the channel settings and status is specified in the following table:

Value measured at input	Channel diagnostics	LED status
-	24 VDC power supply short-circuit	red
Greater than the set measurement range	Greater than the set measurement range	
Less than the measurement range	Less than the measurement range (Only in +/-10 V or 4...20 mA operating mode)	
< 2 mA	Cable breakage (Only for FTM 1AE04C12C configured in 4...20 mA mode)	

Diagnostics Display for FTM 1AS04C12T and FTM 1AS04C12C

The LED behavior according to the channel settings and status is specified in the following table:

Value measured at input	Channel diagnostics	LED status
-	24 VDC power supply short-circuit	red
< 0.3 % of the threshold value of the measurement range	Short circuit (FTM 1AS04C12T only)	
> 2mA	Cable breakage (Only for FTM 1AS04C12C configured in 4...20 mA mode)	

CANopen Objects Diagnostics

Description

When the FTM coupling device detects an error, the following objects are updated. These objects are described in more detail in the "Object Dictionary" chapter:

- **The object 1001H**, **Error Register** displays the generic errors. See Objects dictionary (see *Object 1001H: Error Register, p. 149*)
- **The object 1002H Manufacturer Status Register** displays the errors specific to the FTM splitter box. Objects dictionary (see *Object 1002H: Manufacturer Status Register, p. 150*)
- **The object 1003H, Pre-defined Error Field** saves the latest error codes transmitted by the FTM splitter box. Objects dictionary (see *Object 1003H: Pre-defined Error Field (PEF), p. 151*)

EMCYMessage Structure

For each error, the EMCY message is sent by the splitter box that detected the error via the network (see table structure below).

Once the error has been cleared an EMCY message is sent again, incorporating an "Error code" = 0.

The EMCY message consists of 8 data bytes outlined in the following table:

Byte	**0-1**	**2**	**3**	**4**	**5**	**6**	**7**
Contents	Emergency Error Code	Error register	Splitter box version	Manufacturer Status Register			
Corresponding object	1003H	1001H	-	1002H			

Error Codes (EMCY bytes 0-1)

The table below lists the error codes and their meanings:

Error code	Code diagnostics	Cause
0000H	ERROR_RESET_OR_NO_ERROR	Clearing of one, or all, errors
1000H	GENERIC_ERROR	Internal communication error
210yH	CURRENT_DEVICE_INPUT_SIDE	Power supply detector short-circuit
232yH	SHORT_CIRCUIT_AT_OUTPUTS	Short-circuit, actuator to GND
233yH	ACTUATOR_WARNING	Short-circuit, actuator to 24 VDC
3120H	INPUT_VOLTAGE_TOO_LOW	Under-voltage in detector or module (≥ 11 VDC... ≤ 18 VDC)
3130H	INPUT_VOLTAGE_TOO_HIGH	Over-voltage in detector or module (≥ 30.2 VDC)
3220H	INTERNAL_VOLTAGE_TO_LOW	Under-voltage in module (< 11 VDC)
3320H	OUTPUT_VOLTAGE_TO_LOW	Under-voltage in actuator power supply (≥ 11 VDC...≤ 18 VDC)
3330H	OUTPUT_VOLTAGE_TO_HIGH	Over-voltage in actuator power supply (≥ 30.2 VDC)
3340H	OUTPUT_VOLTAGE_MISSING	Under-voltage in actuator power supply (< 11 VDC)
6101H	SOFTWARE_RX_QUEUE_OVERRUN	The receive buffer has exceeded its internal memory capacity
6102H	SOFTWARE_TX_QUEUE_OVERRUN	The transmit buffer has exceeded its internal memory capacity
7010H	ICAN_WARNING_LEVEL	Send and receive counter > 96
7020H	ICAN_ERROR_PASSIV	Send and receive counter > 128
7030H	ICAN_BUS_OFF	The send error counter has exceeded its capacity
7040H	ICAN_NO_SLAVE	Slave expected but not detected
7050H	ICAN_COMMUNICATION	Communication error (general)
7060H	ICAN_SYNC (slave)	Synchronization lost or exceeded
7070H	ICAN_EVENT_SLAVE (master)	PDO not received by the master
7080H	ICAN_RX_QUEUE_OVERRUN	The receive buffer has exceeded its memory capacity
7090H	ICAN_TX_QUEUE_OVERRUN	The transmit buffer has exceeded its memory capacity
70A0H	ICAN_RX_OVERRUN	The CANopen controller has exceeded its capacity
70B0H	ICAN_ERROR_ACTIV	Transmit/receive error counter > 0

Error code	Code diagnostics	Cause
8100H	COMMUNICATION	Synchronization, transmit/receive error counter > 96
8120H	CAN_IN_ERROR_PASSIVE_MODE	CAN controller interrupted
8130H	LIFE_GUARD_ERROR	Node-Guarding error
8140H	BUS_OFF	The transmit error counter has exceeded its capacity
900yH	DESINA_ERROR	Detection of wire cut on sensor
FF10H	BROKEN_CABLE_ERROR	Cable cut, connector unplugged or GND link not connected / < 4 mA according to setting
FF20H	ANALOG_UPPER_LIMIT	> 10 VDC; > 20 mA
FF30H	ANALOG_LOWER_LIMIT	< -10 VDC; < 4 mA
FF40H	ACTUATOR_PARAM_ERROR	Output configuration error
FF50H	SENSOR_PARAM_ERROR	Input configuration error

y = number of faulty splitter box

Status Register (EMCY Byte 2)

The object 1001H (Error register) is a byte used by the device to display internal errors when an error is detected:

Bit	Meaning	Comments
0	Generic error	See object 1003H
1	Current	See object 1003H
2	Voltage	See object 1003H
3	Temperature	Not monitored
4	Communication error	See object 1003H
5	Reserved	Not monitored
6	Reserved	Not monitored
7	Specific to the manufacturer	Detection of wire cut on sensor

Manufacturer status register (EMCY Byte 4-5-6-7)

The data contained in bytes 4 and 5 corresponds to the splitter box number with the error defined by EMCY byte 7. Data from byte 6 corresponds to errors in the coupling device

The following table indicates the assignment of the 32 bit set:

Byte	Meaning	Bit	Description
4	Faulty splitter box	0	Error on splitter box 1
		...	...
		7	Error on splitter box 8
5	Faulty splitter box	0	Error on splitter box 9
		...	...
		7	Error on splitter box 16
6	Type of coupling device error	0	Error on coupling device
		1	Reserved
		2...5	Communication
		6	Configuration
		7	Detection of wire cut
7	Type of splitter box error	0	Detector power up
		1	Under-voltage in actuator supply
		2	Over-voltage in detector
		3	Voltage too high in actuator power supply
		4	Power supply detector short-circuit
		5	Actuator short-circuit
		6	Bad I/O connection
		7	Analog threshold

Behavior in the Event of Short-circuit / Overload / Under-voltage

Sensors

Short-circuit / overload

The following consequences on the FTM splitter box occur when the sensor power supply experiences a short-circuit or overload:

- The diagnostics LED on the corresponding M12 connector lights up red,
- corresponding diagnostics data is transmitted to the master via the bus,
- all other inputs and outputs will continue to operate correctly.

Disconnecting the M12 connector of the faulty channel results in LED and diagnostics data re-initialization.

Under-voltage / no voltage

There are three under-voltage detection levels:

- 12 VDC ≤ U < 18 VDC: in this case, the splitter box still operates, although:
  - the LED U_A is red,
  - appropriate diagnostics data is sent to the master via the bus
- 7 VDC ≤ U < 12 VDC: in this case, the I/Os no longer operate, however bus communication remains operational:
  - the LED U_A is switched off,
  - the relevant diagnostics data is sent to the master via the bus.
- U < 7 VDC : in this case, the splitter no longer operates.

Note: Sensor power supply is provided by the M12 connectors between pins 1 (+24 VDC) and 3 (0 VDC).

Actuators

Short-circuit / overload

The following consequences on the FTM splitter box occur when an output experiences a short-circuit or overload:

- The diagnostics LED on the corresponding M12 connector lights up red,
- the output status LED lights up red.
- the corresponding diagnostics data is transmitted to the master via the bus.

To be re-activated, a default output must be set to 0 after clearing the error.

Under-voltage / no voltage

There are two under-voltage detection levels:

- 12 VDC ≤ U < 18 VDC: in this case, the splitter box still operates, however:
  - the LED U_S is red,
  - the relevant diagnostics data is sent to the master via the bus.
- U < 12 VDC:
  - the LED U_S switches off,
  - the relevant diagnostics data is sent to the master via the bus.

The Object Dictionary

9

Presentation

Introduction

This chapter provides a description of the object dictionary, the list of objects concerning the communication profile, the hardware profile and the specific manufacturer zone, with a detailed description of each.

What's in this Chapter?

This chapter contains the following sections:

9.1 Usage Rules for Sub-Indexes

Usage Rules for Sub-Indexes

Introduction

Certain objects contain data that is dependent on the physical configuration of the FTM splitter box. The number of Discrete input bytes, for example, will depend on the number of Discrete splitter boxes connected.

In this case, a rule is established for linking the number of the sub-index containing the data with the splitter box position.

Splitter box Numbering Rules

The splitter box numbering system corresponds to the connection order, per segment. The first splitter boxes counted are those connected to segment 0 of the coupling device, from the closest to the furthest away. Next are the splitter boxes of segment 1, etc.

To calculate the sub-indexes, Discrete splitter boxes are separated from analog splitter boxes. The sub-indexes of objects associated with analog splitter boxes do not take into account Discrete splitter boxes, and vice versa.

Example

If in a configuration the first splitter box is analog and the second is Discrete, then sub-indexes 1 and 2 of object 6000H (read Discrete inputs) will correspond to the first Discrete splitter box connected.

Exception

Objects 1027H (list of connected splitter boxes) and 3003H (type of connected splitter boxes) do not differentiate between analog and Discrete splitter boxes. Each sub-index is at the corresponding splitter box number.

Analog splitter boxes: Addressing Rules

For analog splitter boxes, the sub-index addressing rule is as follows:

Sub-index of the channel = (channel number + ((analog splitter box number - 1)*4)).

Discrete splitter boxes: Addressing Rule for 8-Bit Objects

For Discrete splitter boxes, the sub-index addressing rule for 8-bit type objects is as follows:

- sub-index of pin 4 of the splitter box = (2* Discrete splitter box number -1)
- sub-index of pin 2 of the splitter box = (2* Discrete splitter box number -1)

Discrete splitter boxes: Addressing Rule for 16-Bit Objects

For Discrete splitter boxes, the sub-index addressing rule for 16-bit type objects is as follows:

sub-index of the object = Discrete splitter box number

The encoding in the word is as follows:

Bit No.	Most significant byte (MSB)	Least significant byte (LSB)
0	Channel 10 (pin 2, connector 0)	Channel 00 (pin 4, connector 0)
1	Channel 11 (pin 2, connector 1)	Channel 01 (pin 4, connector 1)
2	Channel 12 (pin 2, connector 2)	Channel 02 (pin 4, connector 2)
3	Channel 13 (pin 2, connector 3)	Channel 03 (pin 4, connector 3)
4	Channel 14 (pin 2, connector 4)	Channel 04 (pin 4, connector 4)
5	Channel 15 (pin 2, connector 5)	Channel 05 (pin 4, connector 5)
6	Channel 16 (pin 2, connector 6)	Channel 06 (pin 4, connector 6)
7	Channel 17 (pin 2, connector 7)	Channel 07 (pin 4, connector 7)

Sub-Indexes Used

The following table shows the objects whose number of sub-indexes varies according to the splitter boxes connected.

Object	DE16C12	DE08C12	DE08C08	DD16C12	DD08C12	DD08C08	AI	AO
1027H	1/1							
2000H	1/1						-	
2001H	0/1			1/1			-	
2100H	-						4/4	0/4
2200H	-						0/4	4/4
3003H	1/1							
6000H	2/2		1/2 (a)	2/2		1/2 (a)	-	
6102H	1/1						-	
6200H	0/2			2/2		1/2 (a)	-	
6302H	0/1			1/1			-	
6306H	0/1			1/1			-	
6307H	0/1			1/1			-	
6401H	-						4/4	0/4
6411H	-						0/4	4/4
6422H	-						1/1 (b)	
6423H	-						1/1 (b)	
6426H	-						4/4	0/4
6443H	-						0/4	4/4
6444H	-						0/4	4/4

(a): For Discrete splitter boxes with M8 connectors, only the odd-number sub-index is significant.

(b): Objects 6422H and 6423H have only one sub-index, whatever the number of connected analog splitter boxes.

Reading the table

The first figure represents the sub-indexes that can be used for the splitter box.

The second figure represents the number of sub-indexes created when the splitter box is integrated into the configuration.

Example

For a DE08C12 splitter box (8 x pin 4 inputs), both sub-indexes of object 6200H (write outputs) are reserved but unused.

9.2 Objects of the Communication Profile 1000H to 1FFFH

At a Glance

Introduction

This section lists the objects relating to the communication profile. Each object, with all its technical characteristics, is described according to the CANopen standard.

What's in this Section?

This section contains the following topics:

Object 1000H: Device Type

Description

This object indicates the type of splitter box and its functionalities.

The Least Significant Byte indicates the profile number (401 or 191H, for CANopen standard inputs / outputs).

The Most Significant Byte is called "additional information" and provides details of the splitter box's functionalities:

Bit No.	Meaning is valid if bit = 1
0	The device has discrete inputs
1	The device has discrete outputs
2	The device has analog inputs
3	The device has analog outputs

Characteristics

The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
-	-	UNSIGNED32	-	ro	no	no

Object 1001H: Error Register

Description

This object is used by the device to display internal faults. When a fault is detected, the corresponding bit is therefore activated.

The following faults can be displayed:

Bit	Meaning	Comments
0	Generic error	-
1	Current fault (overload or short-circuit)	-
2	Voltage fault	-
3	Temperature	Unchecked
4	Communication error	-
5	Reserved	Unchecked
6	Reserved	Unchecked
7	Specific to the manufacturer	Detection of wire cut

Characteristics

The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
-	-	UNSIGNED8	-	ro	no	no

Object 1002H: Manufacturer Status Register

Description

Diagnostics data is saved in this double word. This object is contained in the EMCY message, and is sent at the same time in the event of a fault.

The least significant byte contains the error code.

The most significant byte contains the additional information.

The error reference numbers are composed of 16 bit error codes and a customer-specific information field on the additional 16 bit error.

Characteristics

The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
-	-	UNSIGNED32	-	ro	yes	no

Bit Assignment

Note: Bit values:
- 0 : no fault
- 1 : fault

Bit	Meaning
0	Fault on module n+1
...	...
n	Fault on module n+1
...	...
15	Fault on module no. 16
16	Fault on coupling device
17 to 20	Reserved
21	Communication
22	Configuration
23	Detection of wire cut
24	Under-voltage in detector
25	Under-voltage in actuator power supply
26	Over-voltage in detector
27	Over-voltage in actuator power supply
28	Short-circuit in detector power supply
29	Actuator short-circuit
30	Bad I/O connection
31	Analog threshold

Object 1003H: Pre-defined Error Field (PEF)

Description

This object is a double word used to store the most recent faults, as well as their characteristics:

- The Error Code is stored in the Least Significant Byte.
- Additional information Additional Information in the Most Significant Byte.
- The sub-index 0 contains the number of stored errors.

Characteristics

The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Sub-index number (number of latched errors)	UNSIGNED8	0	rw	no	no
1	Most recent error	UNSIGNED32	-	ro	no	no
2	Second to last error	UNSIGNED32	-	ro	no	no
...						
10						

Appearance of a New Fault

When a new fault appears, the codes already present are moved into the upper level sub-indexes: the fault in sub-index 1 is moved to sub-index 2, the fault in sub-index 2 is moved to sub-index 3, etc.

Clearing Faults

Faults can only be cleared by writing the value 0 in the sub-index 0 of object 1003H.

Note: Clearing faults does not remove the error code in the Pre-defined Error Field(PEF).

Indicating Faults

All faults are indicated by the sending of an "Emergency" message (EMCY message). Once an error is eliminated, a EMCY message with the content No-error is sent (Error-Code 0x0000).

List of error codes

Error code (Hex)	Diagnostic	Cause
0000H	ERROR_RESET_OR_NO_ERROR	An error has been rectified
1000H	GENERIC_ERROR	Internal communication error
210yH	CURRENT_DEVICE_INPUT_SIDE	Detector power supply short-circuit (M12 connector)
232yH	SHORT_CIRCUIT_AT_OUTPUTS	Short-circuit, actuator to GND
233yH	ACTUATOR_WARNING	Short-circuit, actuator to 24VDC
3120H	INPUT_VOLTAGE_TOO_LOW	Detector or splitter box on(≥11...≤18 VDC)
3320H	OUTPUT_VOLTAGE_TOO_LOW	Voltage too low in actuator power supply (≥11...≤18 VDC)
3330H	OUTPUT_VOLTAGE_TOO_HIGH	Voltage too high in actuator power supply (≥30.2 VDC
3340H	OUTPUT_VOLTAGE_MISSING_	No actuator power supply (<11VDC)
6101H	SOFTWARE_RX_QUEUE_OVERRUN	Receive memory capacity exceeded
6102H	SOFTWARE_TX_QUEUE_OVERRUN	Transmit memory capacity exceeded
7010H	ICAN_WARNING_LEVEL	Transmit/receive error counter > 96
7020H	ICAN_ERROR_PASSIV	Transmit/receive error counter > 128
7030H	ICAN_BUS_OFF	The send error counter has exceeded its capacity
7040H	ICAN_NO_SLAVE	Slave expected but not detected
7050H	ICAN_COMMUNICATION	Communication error (general)
7060H	ICAN_SYNC(Slave)	Synchronization lost or exceeded
7070H	ICAN_EVENT_SLAVE(Master)	PDO not received by the master
7080H	ICAN_RX_QUEUE_OVERRUN	The receive buffer has exceeded its memory capacity
7090H	ICAN_TX_QUEUE_OVERRUN	The transmit buffer has exceeded its memory capacity
70A0H	ICAN_OVERRUN	The CAN controller has exceeded its capacity
70B0H	ICAN_ERROR_AKTIV	Transmit/receive error counter > 0

Error code (Hex)	Diagnostic	Cause
8100H	COMMUNICATION	Synchronization error from the transmission/ reception counter (EMCY message transmitted if the counter value is > 96)
8120H	CAN_IN_ERROR_PASSIVE_MODE	CAN controller interrupted
8130H	LIFE_GUARD_ERROR	Node-Guarding error
8140H	BUS_OFF	The CAN frame error counter has exceeded its capacity
900yH	DESINA_ERROR	Cut wire detected (y = n° of defect)
FF10H	BROKEN_CABLE_ERROR	Cable cut, connector unplugged or GND link not connected / < 4 mA according to setting
FF20H	ANALOG_UPPER_LIMIT	>10V ; >20mA
FF30H	ANALOG_LOWER_LIMIT	<-10V ; <4mA
FF40H	ACTUATOR_PARAM_ERROR	Output configuration error
FF50H	SENSOR_PARAM_ERROR	Input configuration error

y = number of faulty splitter box

Object 1005H: COB-ID SYNC Message

Description This object contains the synchronization message identifier.

Object Characteristics The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	-	UNSIGNED32	80H	rw	no	yes

Object 1006H: Communication Cycle Period

Description

This object describes the time interval in microseconds between two SYNC signals.SYNC This interval must be at least 10ms with a minimum increment of 1ms. The input is done in a double word.

If the object is not used, the field is set to zero.

If a value between 10 000 and 10 000 000 is entered, the splitter box must receive a SYNCsignal within this time interval. If it does not it goes into "Pre-Operational" status. Maximum tolerance is 1% of the configured value. Monitoring of elapsed times starts when the first SYNC signal is received.

Object Characteristics

The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	-	UNSIGNED32	0	rw	no	yes

Coding the Switching Cycle Period

The threshold values are specified in the following table:

Value type	Decimal values	Hexadecimal values	IntervalSYNCin ms
Standard value	0	0000 0000H	-
Min. value	10 000	0000 2710H	10
-	25 000	0000 61A8H	25
-	25 00 00	0003 D090H	250
-	10 00 000	000F 4240H	1000
-	50 00 000	004C 4B40H	5 000
Max. value	10 00 0000	0098 9680H	10 000

Object 1008H: Manufacturer Device Name

Description This object contains the device name.

Properties The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
-	-	STRING	FTM1CN10	ro	no	no

Object 100AH: Manufacturer Software Version (MSV)

Description This object contains details of the device software version, in the form 'SWxx.yy'.

Object Characteristics The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	-	STRING	Depending on the splitter box version	ro	no	no

Object 100CH: Guard Time

Description

The object 100CH contains the "Guard-Time" parameter expressed in milliseconds. See *"Node-Guarding" and "Life-Guarding" Monitoring Protocols, p. 79*.

Object Characteristics

The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	-	UNSIGNED16	0	rw	no	yes

Common typical values for the "Guard-Time" parameter lie between 250 ms and 2s.

Object 100DH: Life Time Factor

Description

This object contains the "Life-Time-Factor" parameter. It is used to calculate the "Life-Time".

Object Characteristics

The characteristics of this object are outlined in the table below: *"Node-Guarding" and "Life-Guarding" Monitoring Protocols, p. 79*

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	-	UNSIGNED8	0	rw	no	yes

Reliable Operation

To enable reliable and secure operation, the user must enter a "Life-Time-Factor" with a minimum value of 2.

When the value 1 is used, should a delay occur due to the processing of high priority messages or internal processing on the "Node-Guarding" master, the splitter switches back to the "Pre-Operational" default state without generating any errors.

⚠ WARNING

RISK OF UNINTENDED DEVICE OPERATION

Set the "Life-Time-Factor" to a minimum value of 2 to prevent any inadvertent change of state to "Pre-Operational" state.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Object 1010H: Store Parameters

Description

This object is used to store the parameters of the FTM splitter box in backed up memory.

Note: When this object is set to 1, parameters can be backed up.

Characteristics

The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Sub-index number	UNSIGNED8	1	ro	no	no
1	Store all parameters	UNSIGNED32	-	rw	no	no

Operation

To save the parameters, the ASCII "save" character string must be written to the corresponding index (6576 6173H):

	Most significant word		Least significant word	
ISO 8859 (ASCII) signature	e	v	a	s
Value	65H	76H	61H	73H

The read result of a sub-index is always 0000 0001H.

Back-up Behavior

Writing a valid value

The device stores the parameters, and then confirms SDO transmission (downloading initialization response).

Note: When storage fails, the splitter box replies with an Abort SDO Transfer (Abort Code:0606 0000H).

Writing an invalid value

The device refuses storage and replies with an "Abort SDO Transfer" (abort code:0800 002xH with x=0...F).

⚠ WARNING

RISK OF UNINTENDED DEVICE OPERATION

- Do not change the device configuration when it is in “Operational” state.
- To reconfigure the device, put it in the “Pre-Operational” state first and confirm it has entered this state before attempting reconfiguration.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Storage Function

During read access to an appropriate sub-index, the splitter box transmits information on its storage function, in the following format:

Bit	32 to 2	1	0
Meaning if bit = 0	Reserved	The splitter box does not store parameters autonomously	The splitter box does not store parameters when it receives a command
Meaning if bit = 1	Reserved	The splitter box stores parameters autonomously	The splitter box stores parameters when it receives a command

Note: LEDs are not updated during this operation. This takes 1 or 2 secs.

Object 1011H: Restore Default Parameters

Description This object is used to restore the FTM splitter box's "factory" settings.

Properties The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Sub-index number	UNSIGNED8	1	ro	no	no
1	Restore all default parameters.	UNSIGNED32	-	rw	no	no

Note: Restore parameters will only be taken into account after power up.

Operation To restore the parameters, the "load" ASCII character string (6461 6F6CH) must be written to the corresponding sub-index:

	Most significant word		Least significant word	
ISO 8859 (ASCII) signature	d	a	o	l
Value	64H	61H	6FH	6CH

The read result of a sub-index is always 0000 0001H.

Restoration Behavior

Writing a valid value

The splitter box stores the default parameters, and then confirms SDO transmission (downloading initialization response).

Note: Where the restore fails, the splitter box responds by an Abort SDO Transfer (abort code: 0606 0000H).

Writing an invalid value

The splitter box refuses storage and responds by an Abort SDO Transfer (abort code: 002xH 002xH with x=0...F).

Default values are initialized at their correct value after the splitter box is reset (reset node for sub-index 1H – 7FH, reset communication for sub-index 2H) or a new power supply cycle is started.

Restoration function During read access to a correct sub-index, the splitter box transmits information on its default parameter restoration function, in the following format:

Bit	32 to 1	0
Meaning if bit = 0	Reserved	The splitter box does not restore default parameters
Meaning if bit = 1	-	The splitter box restores default parameters

Object 1014H: COB-ID Emergency Message (EMCY)

Description This object contains the EMCY emergency message identifier.

Object Properties The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	-	UNSIGNED32	80H + NODE-ID	rw	no	yes

Object 1016H: Consumer Heartbeat Time

Description

This object is used to monitor the communication of another product on the network. It is particularly used to monitor the master. The value of this object defines the time interval within which the monitored product must send a Heartbeat message.

The splitter box is designed in such a way that it can only monitor one product at a time.

The value of this object must be greater than the value of object 1017H of the monitored product.

The time must be a multiple of 1 ms.

Object Characteristics

The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Sub-index number	UNSIGNED8	1	ro	no	yes
1	Consumer heartbeat time	UNSIGNED32	0	rw	no	yes

Content of Variable

The content of sub-index 1 is as follows:

Bit	31 to 24	23 to 16	15 to 0
Value	0H (Reserved)	Address of the monitored splitter box	Monitoring time in ms

If the value of the sub-index is 0, no splitter box is monitored.

"Node-Guarding" and "Life-Guarding" Monitoring Protocols, p. 79

Object 1017H: Producer Heartbeat Time

Description

This object is used to configure the time interval in ms within which the splitter box must produce the Hearbeat message.

The default monitoring method is Node-Guarding. If a non-zero value is written in this object the Heartbeat mechanism is used.

Object Properties

The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	-	UNSIGNED16	0	rw	no	yes

If the Heartbeat error monitoring protocol is selected, the splitter box periodically sends a Heartbeat message, depending on the "Producer Heartbeat Time"" parameter. The nodes responsible for monitoring this message (Heartbeat Consumer) generate a Heartbeat event if the message is not received within the configured time (Consumer Heartbeat Time) in their object 1016H (see *"Node-Guarding" and "Life-Guarding" Monitoring Protocols, p. 79*).

Object 1018H: Identity Object

Description

This object contains information about the splitter box. It indicates the manufacturer's CiA identifier (Vendor ID), the Product code and the splitter box revision numbers (Revision number).

The revision information is coded in two parts:

- the major revision part (most significant word) indicates an evolution in CANopen functionalities,
- the minor revision part (least significant word) indicates an evolution in splitter functionalities only.

Characteristics

The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Number of inputs	UNSIGNED8	3H	ro	no	no
1	Vendor ID	UNSIGNED32	0500 005AH	ro	no	no
2	Product code	UNSIGNED32	A476H 42102 (Dec.)	ro	no	no
3	Revision number	UNSIGNED32	Version dependant	ro	no	no

Object 1027H: Module List

Description

This object contains a list of the I/O splitter boxes connected to the FTM coupling device.

Object Properties

The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Number of sub-indexes (Number of connected splitter boxes)	UNSIGNED16	n	ro	no	no
1	Product code of the first splitter box	UNSIGNED16	Island dependant	ro	no	no
...						
n	Product code of the last splitter box	UNSIGNED16	Island dependant	ro	no	no

List of Identification Codes

Reference	Identification code (Decimal)	Identification code (Hex)
FTM 1DD16C12	56600	DD18H
FTM 1DD16C12E	56601	DD19H
FTM 1DE16C12	56602	DD1AH
FTM 1DE16C12E	56603	DD1BH
FTM 1DD08C12	56610	DD22H
FTM 1DD08C12E	56611	DD23H
FTM 1DE08C12	56612	DD24H
FTM 1DE08C12E	56613	DD25H
FTM 1DD08C08	56620	DD2CH
FTM 1DD08C08E	56621	DD2DH
FTM 1DE08C08	56622	DD2EH
FTM 1DE08C08E	56623	DD2FH
FTM 1AE04C12T	56700	DD7CH
FTM 1AS04C12T	56710	DD86H
FTM 1AS04C12C	56720	DD90H
FTM 1AE04C12C	56730	DD9AH

Object 1200H: Server SDO Parameter

Description This object contains the message identifiers for SDO communication.

Object Characteristics The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Sub-index number	UNSIGNED8	2H	ro	no	no
1	Client to Server	UNSIGNED32	600H + Node ID	ro	no	no
2	Server to Client	UNSIGNED32	580H + Node ID	ro	no	no

Object 1400H: 1st Receive PDO Communication Parameter

Description This object contains the receive PDO identifier.

Object Characteristics The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Sub-index number	UNSIGNED8	2H	ro	no	yes
1	COB-ID	UNSIGNED32	8000 0200H + Node ID	rw	no	yes
2	Transmission mode	UNSIGNED8	FFH (255 Dec)	rw	no	yes

Transmission Mode The PDO transmission mode can be configured as described in the table below.

Transfer code		Transmission mode				Notes
Dec.	Hex.	Cyclic	Acyclic	Synchronous	Asynchronous	
0	0		x	x		Send PDO on first SYNC message following an event
1 to 240	1 to F0	x		x		Send PDO every x SYNC messages
241 to 251	F1 to FB	Reserved				-
252 to 253	FC to FE	Reserved				-
254 to 255	FE to FF				x	Send PDO on event

Note: For modes 254 and 255, the event triggering the send is defined by the message producer.

Object 1401H: 2nd Receive PDO Communication Parameter

Description This object contains the receive PDO identifier.

Object Characteristics The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Sub-index number	UNSIGNED8	2H	ro	no	yes
1	COB-ID	UNSIGNED32	8000 0300H + Node ID	rw	no	yes
2	Transmission mode	UNSIGNED8	FFH (255 dec.)	rw	no	yes

Transmission mode The PDO transmission mode can be configured as described in the table below.

Transfer code (Dec.)	Transmission mode					Notes
	Cyclic	Acyclic	Synchronous	Asynchronous	RTR only	
0		x	x			Send PDO on first SYNC message following an event
1 to 240	x		x			Send PDO every x SYNC messages
241 to 251	Reserved					-
252 to 253	Reserved					-
254				x		Send PDO on event
255				x		Send PDO on event

Note: For modes 254 and 255, the event triggering the send is defined by the message producer.

Object 1402H: 3rd Receive PDO Communication Parameter

Description This object contains the receive PDO identifier.

Object Characteristics The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Sub-index number	UNSIGNED8	2H	ro	no	yes
1	COB-ID	UNSIGNED32	8000 0400H + Node ID	rw	no	yes
2	Transmission mode	UNSIGNED8	FFH (255 dec.)	rw	no	yes

Transmission mode The PDO transmission mode can be configured as described in the table below.

Transfer code (Dec.)	Transmission mode					Notes
	Cyclic	Acyclic	Synchronous	Asynchronous	only RTR	
0		x	x			Send PDO on first SYNC message following an event
1 to 240	x		x			Send PDO every x SYNC messages
241 to 251	Reserved					-
252 to 253	Reserved					-
254				x		Send PDO on event
255				x		Send PDO on event

Note: For modes 254 and 255, the event triggering the send is defined by the message producer.

Object 1403H: 4th Receive PDO Communication Parameter

Description This object contains the receive PDO identifier.

Object Characteristics The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Sub-index number	UNSIGNED8	2H	ro	no	yes
1	COB-ID	UNSIGNED32	8000 0500H + Node ID	rw	no	yes
2	Transmission mode	UNSIGNED8	FFH (255 dec.)	rw	no	yes

Transmission mode The PDO transmission mode can be configured as described in the table below.

Transfer code (Dec.)	Transmission mode					Notes
	Cyclic	Acyclic	Synchronous	Asynchronous	RTR only	
0		x	x			Send PDO on first SYNC message following an event
1 to 240	x		x			Send PDO every x SYNC messages
241 to 251	Reserved					-
252 to 253	Reserved					-
254				x		Send PDO on event
255				x		Send PDO on event

Note: For modes 254 and 255, the event triggering the send is defined by the message producer.

Object 1404H: 5th Receive PDO Communication Parameter

Description This object contains the receive PDO identifier.

Object Characteristics The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Sub-index number	UNSIGNED8	2H	ro	no	yes
1	COB-ID	UNSIGNED32	8000 0000H	rw	no	yes
2	Transmission mode	UNSIGNED8	FFH (255 dec.)	rw	no	yes

Note: The COB-ID of the 5th PDO is not defined by default. The user must define it, making sure that it is unique on the network. See *List of COB-IDs, p. 227*.

Transmission mode The PDO transmission mode can be configured as described in the table below.

Transfer code (Dec.)	Transmission mode					Notes
	Cyclic	Acyclic	Synchronous	Asynchronous	only RTR	
0		x	x			Send PDO on first SYNC message following an event
1 to 240	x		x			Send PDO every x SYNC messages
241 to 251	Reserved					-
252 to 253	Reserved					-
254				x		Send PDO on event
255				x		Send PDO on event

Note: For modes 254 and 255, the event triggering the send is defined by the message producer.

Object 1600H: 1st Receive PDO Mapping Parameter

Description This object is used to describe the objects that will be transported by the PDO.

Characteristics The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Sub-index number	UNSIGNED8	0	rw	no	yes
1	1st object in PDO	UNSIGNED32	-	rw	no	yes
2	2nd object in PDO	UNSIGNED32	-	rw	no	yes
...						
8	Last object in PDO	UNSIGNED32	-	rw	no	yes

Data Field Structure Each data object to be transported is represented in the following way:

Bits	31 to 16	15 to 8	7 to 0
Data	Index number of object to be transported	Sub-index number of object to be transported	Length of object to be transported
Example	6200H	01H	08H

Note: The maximum length of data transported by the PDO must be 8 bytes.

Object 1601H: 2nd Receive PDO Mapping Parameter

Description This object is used to describe the objects that will be transported by the PDO.

Characteristics The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Sub-index number	UNSIGNED8	0	rw	no	yes
1	1st object in PDO	UNSIGNED32	-	rw	no	yes
2	2nd object in PDO	UNSIGNED32	-	rw	no	yes
...						
8	Last object in PDO	UNSIGNED32	-	rw	no	yes

Data Field Structure Each data object to be transported is represented in the following way:

Bits	31 to 16	15 to 8	7 to 0
Data	Index number of object to be transported	Sub-index number of object to be transported	Length of object to be transported
Example	6200H	01H	08H

Note: The maximum total length of data that can be transported by the PDO is 8 bytes.

Object 1602H: 3rd Receive PDO Mapping Parameter

Description This object is used to describe the objects that will be transported by the PDO.

Characteristics The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Sub-index number	UNSIGNED8	0	rw	no	yes
1	1st object in PDO	UNSIGNED32	-	rw	no	yes
2	2nd object in PDO	UNSIGNED32	-	rw	no	yes
...						
8	Last object in PDO	UNSIGNED32	-	rw	no	yes

Data Field Structure Each data object to be transported is represented in the following way:

Bits	31 to 16	15 to 8	7 to 0
Data	Index number of object to be transported	Sub-index number of object to be transported	Length of object to be transported
Example	6200H	01H	08H

Note: The maximum total length of data that can be transported by the PDO is 8 bytes.

Object 1603H: 4th Receive PDO Mapping Parameter

Description This object is used to describe the objects that will be transported by the PDO.

Characteristics The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Sub-index number	UNSIGNED8	0	rw	no	yes
1	1st object in PDO	UNSIGNED32	-	rw	no	yes
2	2nd object in PDO	UNSIGNED32	-	rw	no	yes
...						
8	Last object in PDO	UNSIGNED32	-	rw	no	yes

Data Field Structure Each data object to be transported is represented in the following way:

Bits	31 to 16	15 to 8	7 to 0
Data	Index number of object to be transported	Sub-index number of object to be transported	Length of object to be transported
Example	6200H	01H	08H

Note: The maximum total length of data that can be transported by the PDO is 8 bytes.

Object 1604H: 5th Receive PDO Mapping Parameter

Description This object is used to describe the objects that will be transported by the PDO.

Characteristics The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Sub-index number	UNSIGNED8	0	rw	no	yes
1	1st object in PDO	UNSIGNED32	-	rw	no	yes
2	2nd object in PDO	UNSIGNED32	-	rw	no	yes
...						
8	Last object in PDO	UNSIGNED32	-	rw	no	yes

Data Field Structure Each data object to be transported is represented in the following way:

Bits	31 to 16	15 to 8	7 to 0
Data	Index number of object to be transported	Sub-index number of object to be transported	Length of object to be transported
Example	6200H	01H	08H

Note: The maximum total length of data that can be transported by the PDO is 8 bytes.

Object 1800H: 1st Transmit PDO Communication Parameter

Description This object contains the PDO transmit identifier.

Properties The properties for this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Sub-index number	UNSIGNED8	5	ro	no	yes
1	COB-ID	UNSIGNED32	8000 0180H + Node ID	rw	no	yes
2	Transmission mode	UNSIGNED8	FFH (255 Dec)	rw	no	yes
3	Inhibit Time	UNSIGNED16	AH (10 dec.)	rw	no	yes
4	Not available					
5	Event Timer	UNSIGNED16	0	rw	no	yes

Transmission Mode The PDO transmission mode can be configured as described in the table below.

Transfer code (Dec.)	Transmission mode					Notes
	Cyclic	Acyclic	Synchronous	Asynchronous	RTR only	
0		x	x			Send PDO on first SYNC message following an event
1 to 240	x		x			Send PDO every x SYNC messages
241 to 251	Reserved					-
252			x		x	Receive SYNC message and send PDO on Remote Request
253					x	Update data and send PDO on Remote Request
254				x		Send PDO on event
255				x		Send PDO on event

Note: For discrete I/Os, the event is the change in value.
For analog I/Os, several events can be selected (cf: object 6421H):

- Change in value
- Overrun of upper threshold
- Overrun of lower threshold
- Change in value greater than configured delta

COB-ID Structure

The structure of a COB-ID for CAN2.0 is shown in the following table:

Bit No.	Value	Meaning
31 (MSb)	0	The PDO object exists
	1	The PDO object does not exist
30	0	RTR mechanism authorized
	1	RTR mechanism not authorized
29	0	11-Bit ID (CAN 2.0A)
28 - 11	0	if bit 29 = 0
10 - 0 (LSb)	X	Bit 10 - 0 of the identifier

Inhibit Time (Sub-index 3)

In the case of PDO transmission (Transmit PDO), the Inhibit Time can be entered in this 16-bit field. After data has been changed, the PDO sender checks that an Inhibit Time has expired since the last transmission. A new PDO transmission can only take place if the Inhibit Time has expired. The Inhibit Timeis useful for asynchronous transmission (transmission mode 255), to avoid overloads on the CAN bus. The Inhibit Time is a multiple of 100 µs of the value written in sub-index 3 of objects 1800H to 1804H.

The following table shows some examples of values.

Value (Hex)	Inhibit Time in ms
0000H	0
64H	10
3E8H	100
1388H	500
2710H	1000
FFFFH	6553.5

Event Timer (Sub-index 5)

TheEvent Timer only works in asynchronous transmission mode (transmission mode 255). If data changes before theEvent Timer expires, a TPDO is sent. If a value higher than 0 is written in the 16-bit field, the TPDO is sent after the Event Timer expires. The value written in sub-index 5 of objects 1800H to 1804H corresponds to the Event Timer in milliseconds. The data transfer takes place even if there is no change to data.

The following table shows some examples of values.

Value (Hex)	Event Timer in ms
0000H	0
000AH	10
64H	100
3E8H	1000
1388H	5000
2710H	10 000

Object 1801H: 2nd Transmit PDO Communication Parameter

Description This object contains the PDO transmit identifier.

Properties The properties for this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Sub-index number	UNSIGNED8	5	ro	no	yes
1	COB-ID	UNSIGNED32	8000 0280H + Node ID	rw	no	yes
2	Transmission mode	UNSIGNED8	FFH (255 Dec)	rw	no	yes
3	Inhibit time	UNSIGNED16	AH (10 dec.)	rw	no	yes
4	Not available					
5	Event Timer	UNSIGNED16	0	rw	no	yes

Transmission Mode The PDO transmission mode can be configured as described in the table below.

Transfer code (Dec.)	Transmission mode					Notes
	Cyclic	Acyclic	Synchronous	Asynchronous	RTR only	
0		x	x			Send PDO on first SYNC message following an event
1 to 240	x		x			Send PDO every x SYNC messages
241 to 251	Reserved					-
252			x		x	Receive SYNC message and send PDO on Remote Request
253					x	Update data and send PDO on Remote Request
254				x		Send PDO on event
255				x		Send PDO on event

Note: For discrete I/Os, the event is the change in value.
For analog I/Os, several events can be selected (cf: object 6421H):

- Change in value
- Overrun of upper threshold
- Overrun of lower threshold
- Change in value greater than configured delta

COB-ID Structure

The structure of a COB-ID for CAN2.0 is shown in the following table:

Bit No.	Value	Meaning
31 (MSb)	0	The PDO object exists
	1	The PDO object does not exist
30	0	RTR mechanism authorized
	1	RTR mechanism not authorized
29	0	11-Bit ID (CAN 2.0A)
28 - 11	0	if bit 29 = 0
10 - 0 (LSb)	X	Bit 10 - 0 of the identifier

Inhibit Time (Sub-index 3)

In the case of PDO transmission (Transmit PDO), the Inhibit Time can be entered in this 16-bit field. After data has been changed, the PDO sender checks that an Inhibit Time has expired since the last transmission. A new PDO transmission can only take place if the Inhibit Time has expired. The Inhibit Timeis useful for asynchronous transmission (transmission mode 255), to avoid overloads on the CAN bus. The Inhibit Time is a multiple of 100 µs of the value written in sub-index 3 of objects 1800H to 1804H.

The following table shows some examples of values.

Value (Hex)	Inhibit Time in ms
0000H	0
64H	10
3E8H	100
1388H	500
2710H	1000
FFFFH	6553.5

Event Timer (Sub-index 5)

TheEvent Timer only works in asynchronous transmission mode (transmission mode 255). If data changes before theEvent Timer expires, a TPDO is sent. If a value higher than 0 is written in the 16-bit field, the TPDO is sent after the Event Timer expires. The value written in sub-index 5 of objects 1800H to 1804H corresponds to the Event Timer in milliseconds. The data transfer takes place even if there is no change to data.

The following table shows some examples of values.

Value (Hex)	Event Timer in ms
0000H	0
000AH	10
64H	100
3E8H	1000
1388H	5000
2710H	10 000

Object 1802H: 3rd Transmit PDO Communication Parameter

Description This object contains the PDO transmit identifier.

Properties The properties for this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Sub-index number	UNSIGNED8	5H	ro	no	yes
1	COB-ID	UNSIGNED32	8000 0380H + Node ID	rw	no	yes
2	Transmission mode	UNSIGNED8	FFH (255 Dec)	rw	no	yes
3	Inhibit Time	UNSIGNED16	AH (10 dec.)	rw	no	yes
4	Not available					
5	Event Timer	UNSIGNED16	0H	rw	no	yes

Transmission mode The PDO transmission mode can be configured as described in the table below.

Transfer code (Dec.)	Transmission mode					Notes
	Cyclic	Acyclic	Synchronous	Asynchronous	RTR only	
0		x	x			Send PDO on first SYNC message following an event
1 to 240	x		x			Send PDO every x SYNC messages
241 to 251	Reserved					-
252			x		x	Receive SYNC message and send PDO on Remote Request
253					x	Update data and send PDO on Remote Request
254				x		Send PDO on event
255				x		Send PDO on event

Note: For discrete I/Os, the event is the change in value.
For analog I/Os, several events can be selected (cf: object 6421H):

- Change in value
- Overrun of upper threshold
- Overrun of lower threshold
- Change in value greater than configured delta

COB-ID Structure

The structure of a COB-ID for CAN2.0 is shown in the following table:

Bit No.	Value	Meaning
31 (MSb)	0	The PDO object exists
	1	The PDO object does not exist
30	0	RTR mechanism authorized
	1	RTR mechanism not authorized
29	0	11-Bit ID (CAN 2.0A)
28 - 11	0	if bit 29 = 0
10 - 0 (LSb)	X	Bit 10 - 0 of the identifier

Inhibit Time (Sub-index 3)

In the case of PDO transmission (Transmit PDO), the Inhibit Time can be entered in this 16-bit field. After data has been changed, the PDO sender checks that an Inhibit Time has expired since the last transmission. A new PDO transmission can only take place if the Inhibit Time has expired. The Inhibit Timeis useful for asynchronous transmission (transmission mode 255), to avoid overloads on the CAN bus. The Inhibit Time is a multiple of 100 µs of the value written in sub-index 3 of objects 1800H to 1804H.

The following table shows some examples of values.

Value (Hex)	Inhibit Time in ms
0000H	0
64H	10
3E8H	100
1388H	500
2710H	1000
FFFFH	6553.5

Event Timer (Sub-index 5)

TheEvent Timer only works in asynchronous transmission mode (transmission mode 255). If data changes before theEvent Timer expires, a TPDO is sent. If a value higher than 0 is written in the 16-bit field, the TPDO is sent after the Event Timer expires. The value written in sub-index 5 of objects 1800H to 1804H corresponds to the Event Timer in milliseconds. The data transfer takes place even if there is no change to data.

The following table shows some examples of values.

Value (Hex)	Event Timer in ms
0000H	0
000AH	10
64H	100
3E8H	1000
1388H	5000
2710H	10 000

Object 1803H: 4th Transmit PDO Communication Parameter

Description This object contains the PDO transmit identifier.

Properties The properties for this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Sub-index number	UNSIGNED8	5H	ro	no	yes
1	COB-ID	UNSIGNED32	8000 0480H + Node ID	rw	no	yes
2	Transmission mode	UNSIGNED8	FFH (255 Dec)	rw	no	yes
3	Inhibit Time	UNSIGNED16	AH (10 dec.)	rw	no	yes
4	Not available					
5	Event Timer	UNSIGNED16	0H	rw	no	yes

Transmission mode The PDO transmission mode can be configured as described in the table below.

Transfer code (Dec.)	Transmission mode					Notes
	Cyclic	Acyclic	Synchronous	Asynchronous	RTR only	
0		x	x			Send PDO on first SYNC message following an event
1 to 240	x		x			Send PDO every x SYNC messages
241 to 251	Reserved					-
252			x		x	Receive SYNC message and send PDO on Remote Request
253					x	Update data and send PDO on Remote Request
254				x		Send PDO on event
255				x		Send PDO on event

Note: For discrete I/Os, the event is the change in value.
For analog I/Os, several events can be selected (cf: object 6421H):

- Change in value
- Overrun of upper threshold
- Overrun of lower threshold
- Change in value greater than configured delta

COB-ID Structure

The structure of a COB-ID for CAN2.0 is shown in the following table:

Bit No.	Value	Meaning
31 (MSb)	0	The PDO object exists
	1	The PDO object does not exist
30	0	RTR mechanism authorized
	1	RTR mechanism not authorized
29	0	11-Bit ID (CAN 2.0A)
28 - 11	0	if bit 29 = 0
10 - 0 (LSb)	X	Bit 10 - 0 of the identifier

Inhibit Time (Sub-index 3)

In the case of PDO transmission (Transmit PDO), the Inhibit Time can be entered in this 16-bit field. After data has been changed, the PDO sender checks that an Inhibit Time has expired since the last transmission. A new PDO transmission can only take place if the Inhibit Time has expired. The Inhibit Timeis useful for asynchronous transmission (transmission mode 255), to avoid overloads on the CAN bus. The Inhibit Time is a multiple of 100 µs of the value written in sub-index 3 of objects 1800H to 1804H.

The following table shows some examples of values.

Value (Hex)	Inhibit Time in ms
0000H	0
64H	10
3E8H	100
1388H	500
2710H	1000
FFFFH	6553.5

Event Timer (Sub-index 5)

TheEvent Timer only works in asynchronous transmission mode (transmission mode 255). If data changes before theEvent Timer expires, a TPDO is sent. If a value higher than 0 is written in the 16-bit field, the TPDO is sent after the Event Timer expires. The value written in sub-index 5 of objects 1800H to 1804H corresponds to the Event Timer in milliseconds. The data transfer takes place even if there is no change to data.

The following table shows some examples of values.

Value (Hex)	Event Timer in ms
0000H	0
000AH	10
64H	100
3E8H	1000
1388H	5000
2710H	10 000

Object 1804H: 5th Transmit PDO Communication Parameter

Description This object contains the PDO transmit identifier.

Properties The properties for this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Sub-index number	UNSIGNED8	5H	ro	no	yes
1	COB-ID	UNSIGNED32	8000 0000H	rw	no	yes
2	Transmission mode	UNSIGNED8	FFH (255 Dec)	rw	no	yes
3	Inhibit Time	UNSIGNED16	AH (10 dec.)	rw	no	yes
4	Not available					
5	Event Timer	UNSIGNED16	0H	rw	no	yes

Note: The COB-ID of the 5th PDO is not defined by default. The user must define it, making sure that it is unique on the network. See *List of COB-IDs, p. 227*.

Transmission mode The PDO transmission mode can be configured as described in the table below.

Transfer code (Dec.)	Transmission mode					Notes
	Cyclic	Acyclic	Synchronous	Asynchronous	RTR only	
0		x	x			Send PDO on first SYNC message following an event
1 to 240	x		x			Send PDO every x SYNC messages
241 to 251	Reserved					-
252			x		x	Receive SYNC message and send PDO on Remote Request
253					x	Update data and send PDO on Remote Request
254				x		Send PDO on event
255				x		Send PDO on event

Note: For discrete I/Os, the event is the change in value.
For analog I/Os, several events can be selected (cf: object 6421H):

- Change in value
- Overrun of upper threshold
- Overrun of lower threshold
- Change in value greater than configured delta

COB-ID Structure

The structure of a COB-ID for CAN2.0 is shown in the following table:

Bit No.	Value	Meaning
31 (MSb)	0	The PDO object exists
	1	The PDO object does not exist
30	0	RTR mechanism authorized
	1	RTR mechanism not authorized
29	0	11-Bit ID (CAN 2.0A)
28 - 11	0	if bit 29 = 0
10 - 0 (LSb)	X	Bit 10 - 0 of the identifier

Inhibit Time (Sub-index 3)

In the case of PDO transmission (Transmit PDO), the Inhibit Time can be entered in this 16-bit field. After data has been changed, the PDO sender checks that an Inhibit Time has expired since the last transmission. A new PDO transmission can only take place if the Inhibit Time has expired. The Inhibit Timeis useful for asynchronous transmission (transmission mode 255), to avoid overloads on the CAN bus. The Inhibit Time is a multiple of 100 µs of the value written in sub-index 3 of objects 1800H to 1804H.

The following table shows some examples of values.

Value (Hex)	Inhibit Time in ms
0000H	0
64H	10
3E8H	100
1388H	500
2710H	1000
FFFFH	6553.5

Event Timer (Sub-index 5)

TheEvent Timer only works in asynchronous transmission mode (transmission mode 255). If data changes before theEvent Timer expires, a TPDO is sent. If a value higher than 0 is written in the 16-bit field, the TPDO is sent after the Event Timer expires. The value written in sub-index 5 of objects 1800H to 1804H corresponds to the Event Timer in milliseconds. The data transfer takes place even if there is no change to data.

The following table shows some examples of values.

Value (Hex)	Event Timer in ms
0000H	0
000AH	10
64H	100
3E8H	1000
1388H	5000
2710H	10 000

Object 1A00H: 1st Transmit PDO Mapping Parameter

Description This object is used to describe the objects that will be transported by the PDO.

Properties The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Sub-index number	UNSIGNED8	0	rw	no	yes
1	1st object in PDO	UNSIGNED32	-	rw	no	yes
2	2nd object in PDO	UNSIGNED32	-	rw	no	yes
...						
8	Most recent object in PDO	UNSIGNED32	-	rw	no	yes

Data Field Structure Each data object to be transported is represented in the following manner:

Bits	31 to 16	15 to 8	7 to 0
Data	Index number of object to be transported	Sub-index number of object to be transported	Length of object to be transported
Example	6200H	01H	08H

Note: The total length of data transported by the mapping method is a maximum of 8 bytes.

Object 1A01H: 2nd Transmit PDO Mapping Parameter

Description This object is used to describe the objects that will be transported by the PDO.

Properties The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Sub-index number	UNSIGNED8	0	rw	no	yes
1	1st object in PDO	UNSIGNED32	-	rw	no	yes
2	2nd object in PDO	UNSIGNED32	-	rw	no	yes
...						
8	Most recent object in PDO	UNSIGNED32	-	rw	no	yes

Data Field Structure Each data object to be transported is represented in the following manner:

Bits	31 to 16	15 to 8	7 to 0
Data	Index number of object to be transported	Sub-index number of object to be transported	Length of object to be transported
Example	6200H	01H	08H

Note: The total length of data transported by the mapping method is a maximum of 8 bytes.

Object 1A02H: 3rd Transmit PDO Mapping Parameter

Description This object is used to describe the objects that will be transported by the PDO.

Properties The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Sub-index number	UNSIGNED8	0	rw	no	yes
1	1st object in PDO	UNSIGNED32	-	rw	no	yes
2	2nd object in PDO	UNSIGNED32	-	rw	no	yes
...						
8	Most recent object in PDO	UNSIGNED32	-	rw	no	yes

Data Field Structure Each data object to be transported is represented in the following manner:

Bits	31 to 16	15 to 8	7 to 0
Data	Index number of object to be transported	Sub-index number of object to be transported	Length of object to be transported
Example	6200H	01H	08H

Note: The total length of data transported by the mapping method is a maximum of 8 bytes.

Object 1A03H: 4th Transmit PDO Mapping Parameter

Description This object is used to describe the objects that will be transported by the PDO.

Properties The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Sub-index number	UNSIGNED8	0	rw	no	yes
1	1st object in PDO	UNSIGNED32	-	rw	no	yes
2	2nd object in PDO	UNSIGNED32	-	rw	no	yes
...						
8	Most recent object in PDO	UNSIGNED32	-	rw	no	yes

Data Field Structure Each data object to be transported is represented in the following manner:

Bits	31 to 16	15 to 8	7 to 0
Data	Index number of object to be transported	Sub-index number of object to be transported	Length of object to be transported
Example	6200H	01H	08H

Note: The total length of data transported by the mapping method is a maximum of 8 bytes.

Object 1A04H: 5th Transmit PDO Mapping Parameter

Description This object is used to describe the objects that will be transported by the PDO.

Properties The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Sub-index number	UNSIGNED8	0	rw	no	yes
1	1st object in PDO	UNSIGNED32	-	rw	no	yes
2	2nd object in PDO	UNSIGNED32	-	rw	no	yes
...						
8	Most recent object in PDO	UNSIGNED32	-	rw	no	yes

Data Field Structure Each data object to be transported is represented in the following manner:

Bits	31 to 16 (MSB)	15 to 8	7 to 0 (LSB)
Data	Index number of object to be transported	Sub-index number of object to be transported	Length of object to be transported
Example	6200H	01H	08H

Note: The total length of data transported by the mapping method is a maximum of 8 bytes.

9.3 Manufacturer-specific Zone Objects 2000H to 5FFFH

At a Glance

Introduction

This section lists the objects from the manufacturer-specific zone. Each object, with all its technical characteristics, is described according to the CANopen standard.

What's in this Section?

This section contains the following topics:

Object 2000H: Input / Diag Parameter

Description

For channels 10 to 17 (connector pin 2) this object is used to select the "input" or "diagnostics input" function.

The diagnostics inputs enable the use of sensors integrating a wire cut detection function.

The object is not significant if the channels are configured as outputs.

Note: For configurable channels, this object's status is taken into account only if the input channel is configured by the 2001H object.

The following table shows each connector's configuration according to sub-index bit value:

Status	Description
0	Discrete input
1	Diagnostics input

Characteristics

The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Number n of discrete modules	UNSIGNED8	n	ro	no	yes
1	Input / diagnostics parameter of first discrete splitter box	UNSIGNED8	FFH	rw	yes	yes
...						
n	Input / diagnostics parameter of last discrete splitter box	UNSIGNED8	FFH	rw	yes	yes

Object 2001H: Input/Output Parameter

Description

This object may only be used for splitter boxes with configurable channels:

Status	Description
0	Input
1	Output

Note: This object takes priority over the 2000H object.

Characteristics

The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Number n of discrete modules	UNSIGNED8	n	ro	no	yes
1	Input / output parameter of first discrete splitter box	UNSIGNED16	0	rw	yes	yes
...						
n	Input / output parameter of last discrete splitter box	UNSIGNED16	0	rw	yes	yes

Object 2100H: Analog Input Type

Description This object is used for configuration of the analog input splitter boxes.

Characteristics The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Number n of analog inputs	UNSIGNED8	n	ro	no	yes
1	Input type of channel 0 of first splitter box	UNSIGNED16	0	rw	yes	yes
...						
n	Input type of channel 4 of the last splitter box	UNSIGNED16	0	rw	yes	yes

Possible Sub-index Values

Bit	Value	Assignment	Filter
0 to 7	0	Not used	-
	1	+/- 10 VDC or 0...20 mA	Not filtered
	2	0...10 VDC or 4...20 mA	Not filtered
	3	+/- 10 VDC or 0...20 mA	Low
	4	0...10 VDC or 4...20 mA	Low
	5	+/- 10 VDC or 0...20 mA	Medium
	6	0...10 VDC or 4...20 mA	Medium
	7	+/- 10 VDC or 0...20 mA	High
	8	0...10 VDC or 4...20 mA	High
	>8	Not used	-
8	0	Diagnostics activated	-
	1	Diagnostics deactivated	-
9	0	MSB/LSB format	-
	1	LSB/MSB format	-
10 to 15	-	Reserved	-

Object 2200H: Analog Output Type

Description

This object defines the range of analog inputs on analogic I/O splitter boxes.

Note: You cannot mix ranges (current, voltage, temperature) for the same analogic I/O splitter box.

Characteristics

The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Number n of analog channels	UNSIGNED8	n	ro	no	yes
1	Output type of channel 0	UNSIGNED16	0	rw	no	yes
...						
n	Output type of last channel	UNSIGNED16	0	rw	no	yes

Possible Sub-index Values

Bit	Value	Assignment
1 to 7	0	Not used
	1	+/- 10 VDC or 0...20mA
	2	0...10 VDC or 4...20 mA
	>3	Reserved
8	0	Diagnostics activated
	1	Diagnostics deactivated
9	0	MSB/LSB format
	1	LSB/MSB format
10	0	Restore preset value in the event of failure
	1	Maintain last value in the event of failure
11 to 15	-	Reserved

Object 3000H: Module Specific Diagnostic

Description

This object provides information on the status of the internal bus of the FTM : CN10 coupling device.

Properties

The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Sub-index number	UNSIGNED8	2	ro	no	no
1	Status of internal bus	UNSIGNED8	0	ro	yes	no
2	Number of distribution modules connected	UNSIGNED8	0	ro	yes	no

Internal Bus Statuses

The internal bus statuses are listed in the following table:

Value	Corresponding status
0	INITIALIZATION
1	OPERATIONAL
127	STOPPED
128	PRE-OPERATIONAL
129	RESET MODE
130	RESET COMM
253	DISCONNECTED
254	FAIL SAFE FIELD BUS
255	NOT FOUND

Object 3002H: Extension Module Revision Number

Description

This object contains the revision numbers of the splitter boxes connected to the network interface coupling device.

The most significant word indicates the revision number of the splitter box and the least significant word indicates the revision number of the software.

Within each word, the most significant byte indicates the major revision number and the least significant byte indicates the minor revision number.

Characteristics

The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Number n of distribution modules connected	UNSIGNED8	n	ro	no	no
1	Revision number of first distribution module	UNSIGNED32	-	ro	no	no
...						
n	Revision number of last distribution module	UNSIGNED32	-	ro	no	no

Object 3003H: Extension Module Type

Description This object contains a type of I/O splitter boxes connected to the FTM coupling device.

Properties The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Number n of distribution modules connected	UNSIGNED8	n	ro	no	no
1	Type of first distribution module	UNSIGNED8	-	ro	no	no
...						
n	Type of last distribution module	UNSIGNED8	-	ro	no	no

Bit Assignment

Bit [1] = TRUE: The device has discrete inputs

Bit [2] = TRUE: The device has discrete outputs

Bit [3] = TRUE: the device has analog inputs,

Bit [4] = TRUE: the device has analog outputs,

Bits [5] to [8]: unused.

9.4 Hardware Profile Objects 6000H to 9FFFH

At a Glance

Introduction

This section lists the objects relating to the hardware profile. Each object, with all its technical characteristics, is described according to the CANopen standard.

What's in this Section?

This section contains the following topics:

Object 6000H: Read Input 8 Bits

Description

This object contains the reading of a group of 8 discrete inputs.

Each splitter box with discrete inputs uses an even number of sub-indexes.

Note: The bit corresponding to a configured outgoing channel reflects the output status commanded by object 6200H.

Characteristics

The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Number n of discrete splitter boxes *2	UNSIGNED8	n	ro	no	no
1	Read input pin 4 of first discrete splitter box (channel 00 to 07)	UNSIGNED8	0	ro	yes	no
2	Read input pin 2 of first discrete splitter box (channel 10 to 17)	UNSIGNED8	0	ro	yes	no
...						
2n	Read input on pin 2 of last discrete splitter box	UNSIGNED8	0	ro	yes	no

The meaning of each bit is given in the following table:

Bit No.	Sub-index 1	Sub-index 2	...	Sub-index 2n-1	Sub-index 2n
0	Read of channel 00 of the first splitter box	Read of channel 10 of the first splitter box	...	Read of channel 00 of the last splitter box	Read of channel 10 of the last splitter box
1	Read of channel 01 of the first splitter box	Read of channel 11 of the first splitter box	...	Read of channel 01 of the last splitter box	Read of channel 11 of the last splitter box
...	...	...	...	...	...
6	Read of channel 06 of the first splitter box	Read of channel 16 of the first splitter box	...	Read of channel 06 of the last splitter box	Read of channel 16 of the last splitter box
7	Read of channel 07 of the first splitter box	Read of channel 17 of the first splitter box	...	Read of channel 07 of the last splitter box	Read of channel 17 of the last splitter box

Object 6102H: Polarity Inputs 16 Bits

Description This object is used to define the polarity of inputs:

- 0 = input not reversed
- 1 = reversed input

Characteristics The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Number n of discrete splitter boxes	UNSIGNED8	n	ro	no	yes
1	Input polarity of first discrete splitter box	UNSIGNED16	0	rw	yes	yes
...						
n	Input polarity of last discrete splitter box	UNSIGNED16	0	rw	yes	yes

Object 6103H: Filter Mask Input 16 Bits

Description This object is used to configure the mask for inputs:

- 0 = input read
- 1 = input ignored

Characteristics The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Number n of discrete splitter boxes	UNSIGNED8	n	ro	no	yes
1	Input form of the first discrete splitter box	UNSIGNED16	0	rw	yes	yes
...						
n	Input form of the last discrete splitter box	UNSIGNED16	0	rw	yes	yes

Object 6200H: Write Outputs 8 Bits

Description This object contains the write objects for a group of 8 discrete outputs.

The bits corresponding to a configured incoming channel have no effect.

Properties The properties for this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Number n of discrete splitter boxes *2	UNSIGNED8	2*n	ro	no	yes
1	Writing the 8 output bits for the first discrete splitter box (channels 00 to 07).	UNSIGNED8	0	rw	yes	yes
2	Writing the 8 output bits for the first discrete splitter box (channels 10 to 17).	UNSIGNED8	0	rw	yes	yes
...						
2*n	Writing the 8 output bits for the last discrete splitter box (channels 10 to 17).	UNSIGNED8	0	rw	yes	yes

n = number of discrete splitter boxes

Note: The sub-indexes relating to discrete entry splitter boxes do not exist.

Object 6302H: Polarity Outputs 16 Bits

Description This object contains the polarity for a group of 16 discrete outputs:

Status	Description
0 (output not reversed)	• Active at 1
1 (output reversed)	• Active at 0

Characteristics The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Number n of discrete modules	UNSIGNED8	n	ro	no	yes
1	Polarity of output the first discrete splitter box	UNSIGNED16	0	rw	no	yes
...						
n	Polarity of output of the last discrete splitter box	UNSIGNED16	0	rw	no	yes

Object 6306H:Fallback Mode Output 16 Bits

Description

This object indicates the fallback mode adopted by outputs in the event of an internal fault or a communication fault.

Status	Description
0	Maintain value
1	Fallback value (defined in object 6307H)

Characteristics

The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Sub-index number	UNSIGNED8	n	ro	no	yes
1	Fallback mode of the first discrete splitter box	UNSIGNED16	0	rw	yes	yes
...						
n	Fallback mode of the last discrete splitter box	UNSIGNED16	0	rw	yes	yes

Object 6307H: Fallback Value Output 16 Bits

Description The object indicates the fallback value adopted by outputs in the event of an internal fault or a communication fault if the corresponding bit in the object 6306H is at 1.

Characteristics The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Number n of discrete modules	UNSIGNED8	n	ro	no	yes
1	Fallback value of the first discrete splitter box	UNSIGNED16	0	rw	yes	yes
...						
n	Fallback value of the last discrete splitter box	UNSIGNED16	0	rw	yes	yes

Object 6401H: Read Analog Input 16 Bits

Description Analog input values are stored in this object.

Each channel uses one sub-index.

Characteristics The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO mapping	Backed up
0	Number n of analog channels	UNSIGNED8	n	ro	no	no
1	Read analog inputs on channel 0 of first analog splitter box	INTEGER16	0	ro	yes	no
...						
n	Write last analog input of last analog splitter box	INTEGER16	0	ro	yes	no

Object 6411H: Write Analog Output 16 Bits

Description This object contains the writing of an analog output.

Characteristics The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Number of analog channels	UNSIGNED8	n	ro	no	yes
1	Write analog output on channel 0 of first analog splitter box	INTEGER16	0	rw	yes	yes
...						
n	Write last analog output of last analog splitter box	INTEGER16	0	rw	yes	yes

Object 6422H: Analog Input Interrupt Source

Description This object contains the number of the channel which generated the PDO send.

Properties The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Sub-index number	UNSIGNED8	1	ro	no	yes
1	Number of channel that generated the PDO send.	UNSIGNED32	-	ro	yes	yes

Object 6423H: Analog Input Global Interrupt Enable

Description This object defines the event which will trigger a PDO send. If the value is 1 a PDO will be sent every time the input value changes.

Properties The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
-	-	BOOLEAN	0	rw	no	yes

Note: If the value is 0, no analog PDO will be sent in mode 254 and 255.

Object 6426H: Analog Input Delta Value

Description This object defines the Delta value which will trigger a PDO send.

Properties The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO Mapping	Backed up
0	Number n of analog channels	UNSIGNED8	n	ro	no	yes
1	Delta value of channel 0 of first module	UNSIGNED32	0	rw	no	yes
...						
n	Delta value of last channel of last splitter box	UNSIGNED32	0	rw	no	yes

Object 6443H: Analog Output Fallback Mode

Description

This object indicates the error mode adopted by analog outputs in the event of an internal fault or a communication fault.

Status	Description
0	Maintain value
1	Fallback value (defined in object 6444H)

Characteristics

The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO mapping	Backed up
0	Number n of analog channels	UNSIGNED8	n	ro	no	yes
1	Error mode on channel 0 of the first analog module	UNSIGNED8	1	rw	yes	yes
...						
n	Error mode on the last channel of the last analog splitter box	UNSIGNED8	1	rw	yes	yes

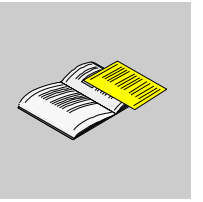
Object 6444H: Analog Output Fallback Value

Description The object indicates the fallback value adopted by outputs in the event of an internal fault or a communication fault if the corresponding sub-index in the object 6443H is at 1.

Characteristics The characteristics of this object are outlined in the following table:

Sub-index	Description	Data type	Default value	Access	PDO mapping	Backed up
0	Number n of analog channels	UNSIGNED8	n	ro	no	yes
1	Fallback value on channel 0 of the first analog module	INTEGER32	0	rw	yes	yes
...						
n	Fallback value on the last channel of the last analog splitter box	INTEGER32	0	rw	yes	yes

Appendices



Introduction

At a Glance

This chapter contains the appendices which may be helpful when configuring the CANopen network.

What's in this Appendix?

The appendix contains the following chapters:

IEC Symbols

A

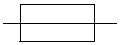
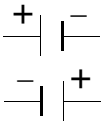
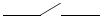
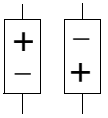
Glossary of Symbols

Introduction

This section contains illustrations and definitions of common IEC symbols used in describing wiring schematics.

Symbols

Common IEC symbols are illustrated and defined in the table below:

	Fuse
	Load
	AC power
	DC power
	Digital sensor/input, for example, contact, switch, initiator, light barrier, and so on.
	Earth ground
	2-wire sensor
	Thermocouple element

COB-ID

B

List of COB-IDs

Introduction

This table shows the COB-IDs reserved for PDOs on the CANopen network. There is no default COB-ID for the fifth PDO of a CANopen node. To assign a COB-ID for the 5th PDO of an FTM splitter box, you just need to select a COB-ID that is not used by the network. This can be a COB-ID that corresponds to an address of a free node, or one that corresponds to a PDO that is not used by an existing node.

Note: You must check that the COB-IDs are unique on the network.

List The COB-IDs on the CANopen network are listed in the following table:

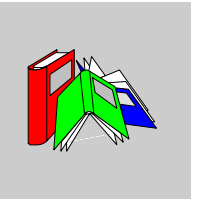
Address	PDO 1400	PDO 1401	PDO 1402	PDO 1403	PDO 1404	PDO 1800	PDO 1801	PDO 1802	PDO 1803	PDO 1804
0	512	768	1024	1280		384	640	896	1152	
1	513	769	1025	1281		385	641	897	1153	
2	514	770	1026	1282		386	642	898	1154	
3	515	771	1027	1283		387	643	899	1155	
4	516	772	1028	1284		388	644	900	1156	
5	517	773	1029	1285		389	645	901	1157	
6	518	774	1030	1286		390	646	902	1158	
7	519	775	1031	1287		391	647	903	1159	
8	520	776	1032	1288		392	648	904	1160	
9	521	777	1033	1289		393	649	905	1161	
10	522	778	1034	1290		394	650	906	1162	
11	523	779	1035	1291		395	651	907	1163	
12	524	780	1036	1292		396	652	908	1164	
13	525	781	1037	1293		397	653	909	1165	
14	526	782	1038	1294		398	654	910	1166	
15	527	783	1039	1295		399	655	911	1167	
16	528	784	1040	1296		400	656	912	1168	
17	529	785	1041	1297		401	657	913	1169	
18	530	786	1042	1298		402	658	914	1170	
19	531	787	1043	1299		403	659	915	1171	
20	532	788	1044	1300		404	660	916	1172	
21	533	789	1045	1301		405	661	917	1173	
22	534	790	1046	1302		406	662	918	1174	
23	535	791	1047	1303		407	663	919	1175	
24	536	792	1048	1304		408	664	920	1176	
25	537	793	1049	1305		409	665	921	1177	
26	538	794	1050	1306		410	666	922	1178	
27	539	795	1051	1307		411	667	923	1179	
28	540	796	1052	1308		412	668	924	1180	
29	541	797	1053	1309		413	669	925	1181	
30	542	798	1054	1310		414	670	926	1182	
31	543	799	1055	1311		415	671	927	1183	

Address	PDO 1400	PDO 1401	PDO 1402	PDO 1403	PDO 1404	PDO 1800	PDO 1801	PDO 1802	PDO 1803	PDO 1804
32	544	800	1056	1312		416	672	928	1184	
33	545	801	1057	1313		417	673	929	1185	
34	546	802	1058	1314		418	674	930	1186	
35	547	803	1059	1315		419	675	931	1187	
36	548	804	1060	1316		420	676	932	1188	
37	549	805	1061	1317		421	677	933	1189	
38	550	806	1062	1318		422	678	934	1190	
39	551	807	1063	1319		423	679	935	1191	
40	552	808	1064	1320		424	680	936	1192	
41	553	809	1065	1321		425	681	937	1193	
42	554	810	1066	1322		426	682	938	1194	
43	555	811	1067	1323		427	683	939	1195	
44	556	812	1068	1324		428	684	940	1196	
45	557	813	1069	1325		429	685	941	1197	
46	558	814	1070	1326		430	686	942	1198	
47	559	815	1071	1327		431	687	943	1199	
48	560	816	1072	1328		432	688	944	1200	
49	561	817	1073	1329		433	689	945	1201	
50	562	818	1074	1330		434	690	946	1202	
51	563	819	1075	1331		435	691	947	1203	
52	564	820	1076	1332		436	692	948	1204	
53	565	821	1077	1333		437	693	949	1205	
54	566	822	1078	1334		438	694	950	1206	
55	567	823	1079	1335		439	695	951	1207	
56	568	824	1080	1336		440	696	952	1208	
57	569	825	1081	1337		441	697	953	1209	
58	570	826	1082	1338		442	698	954	1210	
59	571	827	1083	1339		443	699	955	1211	
60	572	828	1084	1340		444	700	956	1212	
61	573	829	1085	1341		445	701	957	1213	
62	574	830	1086	1342		446	702	958	1214	
63	575	831	1087	1343		447	703	959	1215	
64	576	832	1088	1344		448	704	960	1216	
65	577	833	1089	1345		449	705	961	1217	

Address	PDO 1400	PDO 1401	PDO 1402	PDO 1403	PDO 1404	PDO 1800	PDO 1801	PDO 1802	PDO 1803	PDO 1804
66	578	834	1090	1346		450	706	962	1218	
67	579	835	1091	1347		451	707	963	1219	
68	580	836	1092	1348		452	708	964	1220	
69	581	837	1093	1349		453	709	965	1221	
70	582	838	1094	1350		454	710	966	1222	
71	583	839	1095	1351		455	711	967	1223	
72	584	840	1096	1352		456	712	968	1224	
73	585	841	1097	1353		457	713	969	1225	
74	586	842	1098	1354		458	714	970	1226	
75	587	843	1099	1355		459	715	971	1227	
76	588	844	1100	1356		460	716	972	1228	
77	589	845	1101	1357		461	717	973	1229	
78	590	846	1102	1358		462	718	974	1230	
79	591	847	1103	1359		463	719	975	1231	
80	592	848	1104	1360		464	720	976	1232	
81	593	849	1105	1361		465	721	977	1233	
82	594	850	1106	1362		466	722	978	1234	
83	595	851	1107	1363		467	723	979	1235	
84	596	852	1108	1364		468	724	980	1236	
85	597	853	1109	1365		469	725	981	1237	
86	598	854	1110	1366		470	726	982	1238	
87	599	855	1111	1367		471	727	983	1239	
88	600	856	1112	1368		472	728	984	1240	
89	601	857	1113	1369		473	729	985	1241	
90	602	858	1114	1370		474	730	986	1242	
91	603	859	1115	1371		475	731	987	1243	
92	604	860	1116	1372		476	732	988	1244	
93	605	861	1117	1373		477	733	989	1245	
94	606	862	1118	1374		478	734	990	1246	
95	607	863	1119	1375		479	735	991	1247	
96	608	864	1120	1376		480	736	992	1248	
97	609	865	1121	1377		481	737	993	1249	
98	610	866	1122	1378		482	738	994	1250	
99	611	867	1123	1379		483	739	995	1251	

Address	PDO 1400	PDO 1401	PDO 1402	PDO 1403	PDO 1404	PDO 1800	PDO 1801	PDO 1802	PDO 1803	PDO 1804
100	612	868	1124	1380		484	740	996	1252	
101	613	869	1125	1381		485	741	997	1253	
102	614	870	1126	1382		486	742	998	1254	
103	615	871	1127	1383		487	743	999	1255	
104	616	872	1128	1384		488	744	1000	1256	
105	617	873	1129	1385		489	745	1001	1257	
106	618	874	1130	1386		490	746	1002	1258	
107	619	875	1131	1387		491	747	1003	1259	
108	620	876	1132	1388		492	748	1004	1260	
109	621	877	1133	1389		493	749	1005	1261	
110	622	878	1134	1390		494	750	1006	1262	
111	623	879	1135	1391		495	751	1007	1263	
112	624	880	1136	1392		496	752	1008	1264	
113	625	881	1137	1393		497	753	1009	1265	
114	626	882	1138	1394		498	754	1010	1266	
115	627	883	1139	1395		499	755	1011	1267	
116	628	884	1140	1396		500	756	1012	1268	
117	629	885	1141	1397		501	757	1013	1269	
118	630	886	1142	1398		502	758	1014	1270	
119	631	887	1143	1399		503	759	1015	1271	
120	632	888	1144	1400		504	760	1016	1272	
121	633	889	1145	1401		505	761	1017	1273	
122	634	890	1146	1402		506	762	1018	1274	
123	635	891	1147	1403		507	763	1019	1275	
124	636	892	1148	1404		508	764	1020	1276	
125	637	893	1149	1405		509	765	1021	1277	
126	638	894	1150	1406		510	766	1022	1278	
127	639	895	1151	1407		511	767	1023	1279	

Glossary



A

Analog Input — A module containing circuits that enable analog dc (direct current) input signals to be converted into discrete values that can be handled by the processor. This implies that the analog inputs are generally direct values — in other words: a value in the data table is a direct reflection of the analog signal value.

Analog output — A module containing circuits that transmit an analog dc (direct current) input signal proportional to a discrete input value to the processor module. This implies that the analog outputs are generally direct values — in other words: a value in the data table directly governs the analog signal value.

Application object — On networks based on the CAN protocol, application objects represent a specific functionality of the device, such as the state of input or output data.

Automatic baud rate selection — Automatic assignment and detection of a common baud rate, as well as a device's capacity to adapt to this rate.

Automatic configuration — The capacity of island modules to operate with preset default settings. An island bus configuration wholly based on a physical assembly of I/O modules.

C

CAL

The CANopen protocol was created as a subset of CAL. The CAL specification (CAN Application Layer) comes from when an extended communication capacity adapted to distributed systems and based on the layer 2 protocol in the form of an application layer (layer 7) was made available.

CAN

Controller Area Network. The CAN protocol (ISO 11898) for serial bus networks is designed to connect a series of intelligent devices (from different manufacturers) together into intelligent systems for real-time industrial applications. Multi-master CAN systems provide a high level of data integrity, by implementing message broadcast mechanisms and a strict error checking procedure. Initially developed for the automotive industry, the CAN protocol is now used in a wide range of automation environments.

CANopen, protocol

An open standard industrial protocol used on the internal communication bus. This protocol can be used to connect any CANopen standard-compliant device to the island bus.

CiA

CAN in Automation. The acronym CiA denotes a non-profit making organization of manufacturers and users who wish to promote and develop the use of high layer protocols based on CAN.

COB

*Communication Object*A communication object is a unit of transfer (a "message") used on a CAN network. Communication objects indicate specific device functionality. They are specified in the CANopen communication profile.

D

DESINA

Standard relating to the connector technology of sensors and actuators, established by a German association of machine manufacturers.

Differential input

An input design in which two wires (+ and -) run from each signal source to the data acquisition interface. The voltage between the input and the interface ground is measured by two high-impedance amplifiers, and the outputs of the two amplifiers are subtracted by a third amplifier to give the difference between the + and - inputs. The voltage common to the two wires is thus eliminated. A differential design eliminates the problem of ground differences encountered with single end connections. It also minimizes the problem of noise interference between channels.

Discrete input/ output Another expression used is discrete input/output. Designates an input or output featuring an individual circuit connection to the module corresponding directly to a bit or word of the data table storing the value of the signal on this I/O circuit. A discrete I/O gives the control logic discrete access to I/O values.

E

EDS *Electronic Data Sheet*. The EDS is a file in standard ASCII format containing information on a communication function of a network device and the content of its object dictionary. The EDS also defines device-specific and manufacturer-specific objects.

EIA *Electronic Industries Association.* Body that draws up data communication and electrical/electronic standards.

Electro-magnetic interferences Electro-magnetic interferences (EMI) are liable to cause interruptions, anomalies or disturbances in the performance of electronic hardware. They occur when a source electronically transmits a signal that interferes with other devices.

EMC *Electro-Magnetic Compatibility.* Devices that comply with EMC requirements are capable of error-free operation within the specified electro-magnetic limits of the system.

F

Fallback mode A mode to which any Advantys I/O module can revert should the communication connection fail.

Fallback value The value adopted by a device when it enters the fallback mode. Generally, the fallback value is either configured, or is the device's last stored value.

I

IEC — *International Electrotechnical Commission.* Commission officially founded in 1906 and devoted to the advancement of theory and practice in the following sciences: electrical engineering, electronic engineering, information technology and computer engineering. The IEC 1131 standard covers industrial automation equipment.

IEC type 1 input — Type 1 discrete inputs support sensor signals from mechanical switching devices such as relay contacts and push-buttons operating under normal climatic conditions.

IEC type 1+ input — Type 1+ discrete inputs support sensor signals from mechanical switching devices such as relay contacts and push-buttons (under normal to moderate climatic conditions), three-wire proximity switches and two-wire proximity switches with the following characteristics:

- A voltage drop of less than or equal to 8 V
- A minimum operating current capacity of less than or equal to 2 mA
- A maximum current in blocked state of less than or equal to 0.8 mA

IEC type 2 input — Type 2 discrete inputs support sensor signals from solid-state devices and mechanical switching devices such as relay contacts, push-buttons (under normal to rigorous climatic conditions), and two or three-wire proximity switches.

IEEE — *Institute of Electrical and Electronics Engineers, Inc.* An international association for the standardization and evaluation of compliance in all areas of electro-technology, including electricity and electronics.

Input filter — The period for which a sensor must keep its signal activated/deactivated before the input module detects a change of state.

Input polarity — The polarity of an input channel determines when the input module sends a 1 (one) and when it sends a 0 (zero) to the master controller. If the polarity is *normal*, an input channel will send a 1 (one) to the controller as soon as its fieldbus sensor is activated. If the polarity is *reversed*, an input channel will send a 0 (zero) to the controller as soon as its fieldbus sensor is activated.

Input response time — The time required for an input channel to receive a signal from a fieldbus sensor and pass it on to the island bus.

L

LSB *Least Significant Byte.* The part of a number, address or field that is written as the value furthest to the right in conventional hexadecimal or binary notation.

LSb *Least Significant Bit.* The part of a number, address or field that is written as the value furthest to the right in conventional hexadecimal or binary notation.

M

Master/slave model In a network using a master/slave model, the direction of control is always from the master to slave devices.

MSB *Most Significant Byte.* The part of a number, address or field that is written as the value furthest to the left in conventional hexadecimal or binary notation.

MSb *Most Significant Bit.* The part of a number, address or field that is written as the value furthest to the left in conventional hexadecimal or binary notation.

N

N.C. contact Designates a *normally closed* contact. Also called break contacts. A pair of relay contacts that is closed when the relay coil is low and open when it is energized.

N.O. contact *Normally Open Contact* Also called make contacts. A pair of relay contacts that is open when the relay coil is low and closed when it is energized.

NEMA *National Electrical Manufacturers Association.*

NMT *Network management*.NMT protocols offer services for network initialization, error checking and checking device states.

O

Object — The arrangement and connections made between the hardware components of a system, as well as the selected hardware and software options that determine the system's operating characteristics.

Object Dictionary — Sometimes referred to as the "object directory", this element of the CANopen device model provides the plan for the internal structure of CANopen devices (in accordance with the DS-401 CANopen profile). The object dictionary of a given device is a conversion table describing the data types, the communication objects and the application objects used by the device. By accessing the object dictionary structure of a specific device via the CANopen fieldbus, you can anticipate its network behavior enabling you to design a distributed application in which it can be implemented.

Open industrial communication network — A distributed communication network for industrial environments, based on open standards (EN 50235, EN50254 and EN50170, to citer a few) that enable data to be exchanged between devices from different manufacturers.

Output filter — The time it takes for an output channel to transmit change of state information to an actuator once the output module has received updated data from the NIM.

Output polarity — The polarity of an output channel determines when the output module activates its fieldbus actuator and when it deactivates. If the polarity is *normal*, an output channel will activate its actuator as soon as the master controller sends it the value 1. If the polarity is *reversed*, an output channel will activate its actuator as soon as the master controller sends it the value 0.

Output response time — The time it takes for an output module to receive an output signal from the island bus and transmit it to its fieldbus actuator.

P

Parameterize — To specify the value required by a device attribute during execution.

PDO, object *"Process Data Object"* On networks based on CAN technology, PDOs (Process Data Objects) are transmitted as broadcast messages without confirmation or sent from a producer device to a consumer device. The transmitted PDO (TxPDO) from the producer device has a specific identifier corresponding to the PDO (RxPDO) received from client devices.

PE *Protective Earth* in English, Ground.

Peer to peer communications In peer to peer communications, there is no master/slave or client/server relation. Messages are exchanged between entities of comparable or equivalent levels of functionality, without needing to pass via a third party such as a master device.

PLC *In English: PLC or Programmable Logic Controller.* The PLC is the nerve center of the industrial manufacturing process. Such a device is said to "automate a process", in contrast to a relay control system. These PLCs are in fact simply computers designed to survive under the sometimes harsh conditions of an industrial environment.

Producer/ consumer model On networks employing a producer/consumer model, data packets are identified by their data content rather than their physical position. All nodes "listen" to the network and consume data packets with identifiers corresponding to their functionality.

R

Reflex action The execution of a simple logic command function configured locally on an I/O module of the island bus. Reflex actions are executed by island bus modules on data from various locations on the island, such as input and output modules or the NIM. For example, reflex actions include copy and compare operations.

Repeater A connection device that extends the authorized length of a bus.

Reverse polarity protection In a circuit, use of a diode to protect against damage and any inadvertent operations that may be caused if the polarity of the applied power is accidentally reversed.

ro Read-only.

rw Read-write.

Rx *Reception.* On a CAN network, for example, a PDO is described as an RxPDO of the receiving device.

S

SDO, object — *Service Data Object*. On CAN networks, the fieldbus master (CANopen) uses SDO messages for (read/write) access to the network node object dictionaries.

Sink load (or positive logic load) — Designates an output which, when activated, receives DC current from its load.

Source load — Also called a negative logic load. Designates a load with a directed input current. This load must come from a current source.

T

Tx — *Transmission*.On a CAN network, for example, a PDO is described as a TxPDO of the transmitting device.

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