Advantys FTM DeviceNet IP67 Modular I/O Splitter Box User guide

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Table of Contents

Safety Information 7

About the Book 9

Chapter 1 Introduction 11
At a Glance 11
System Architecture 12
Overview of the Product Range 15
Presentation of the Accessories Range 18
Use of the Diagnostics Function of Pin 2 21

Chapter 2 Installation 23
At a Glance 23
Overview 24
Installing the Coupling Device 27
Grounding 29
EMC Compatibility 31
Installing a Splitter Box 34

Chapter 3 Properties and Wiring of FTM Coupling Devices 37
At a Glance 37
FTM Splitter box Environment Properties 38
Electrical Properties of Module 39
How to Connect the Power Supply 40
Internal Bus Connection 43

Chapter 4 FTM Splitter Box Properties and Wiring 45
At a Glance 45
Electrical Properties of Discrete Splitter Boxes 46
Connection of Actuators and Sensors to Discrete Splitter Boxes 47
Electrical Characteristics of Analog Splitter Boxes 49
Connection of Actuators and Sensors to Analog Splitter Boxes 50

Chapter 5 DeviceNet Network Interface 51
At a Glance 51
5.1 Cabling on the DeviceNet Bus 53

Presentation . . . 53
Choice of System Cables . . . 54
Connecting the Field Bus . . . 55
Configuring the Address and Speed of the Distributor . . . 59
5.2 General Principles . . . 61
At a Glance . . . 61
DeviceNet Description . . . 62
Transmission Modes . . . 64
Bus Load and Reaction Time in "Polling" Operating Mode . . . 65
General Characteristics of the DeviceNet System . . . 67
5.3 Behavior . . . 68
Presentation . . . 68
Behavior at Power-up . . . 69
Behavior for Communication Error . . . 70
Behavior in the Case of Internal Bus Errors . . . 71
Saving and Restoring Parameters . . . 72

Chapter 6 Application-Specific Functions . . . 73
At a Glance . . . 73
Application-Specific Functions Description . . . 74
Discrete I/Os description . . . 75
Description of Analog I/Os . . . 77
Measurement Ranges and Scales . . . 79
Splitter box Channel Types . . . 82

Chapter 7 Software Installation . . . 83
At a Glance . . . 83
Possible Configurations . . . 84
Step-by-Sep Procedure . . . 85
Configuring the Splitter Boxes Associated to the FTM 1DN10 Coupling Device . 88

Chapter 8 Diagnostics . . . 93
At a Glance . . . 93
Power supply diagnostics . . . 94
Field Bus Status Diagnostics LED . . . 96
Internal Bus Diagnostics LEDs . . . 97
Discrete I/O Diagnostics LEDs . . . 98
Analog I/O Diagnostics LEDs . . . 99
Software Diagnostics . . . 100
Behavior in the Event of Short-circuit / Overload / Under-voltage . . . 101

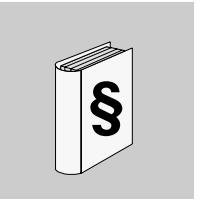
Chapter 9 Object Dictionary . . . 103
At a Glance . . . 103
9.1 Structure of Objects . . . 105
Presentation . . . 105
General Structure of Objects . . . 106

Class Summary 107
9.2 Class 1H, Identity object 108
Description 108
Class 1H: Instance 0H. 109
Class 1H: Instance 1H. 109
9.3 Class 2H, Message Router Object 110
Attributes and Available Services 110
9.4 Class 3H, DeviceNet Object 111
At a Glance 111
Class 3H: Instance 0H. 112
Class 3H: Instance 1H. 112
9.5 Class 4H: Assembly Object. 113
At a Glance 113
Class 4H: Instance 0H. 114
Class 4H: Instance 64H. 115
Class 4H: Instance 65H. 116
9.6 Class 5H, Connection Object 117
At a Glance 117
Class 5: Instance 0H 118
Class 5: Instances 1H to 4H 119
9.7 Class 2BH, Acknowledge handler Object 120
At a Glance 120
Class 2BH: Instance 0H 121
Class 2BH: Instance 1H 121
9.8 Class 64H, Coupling Device Configuration 122
Presentation 122
Class 64H: Instance 0H. 123
Class 64H: Instance 1H. 123
9.9 Class 65H, Splitter Boxes 125
Presentation 125
Class 65H: Instance 0H. 126
Class 65H: Instance 1H and the Following Instances. 126
Class 65H: 1H and Following Instances, Attributes 3H to 27H. 127
Class 65H: 1H and Following Instances, Attributes 28H to 4F of Discrete Splitter Boxes 130
Class 65H: 1H and Following Instances, Attributes 28H to 33H for Analog Splitter Boxes 131
Class 65H: 1H and Following Instances, Attributes 50H to 64H. 134

Glossary 139

Index 145

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.

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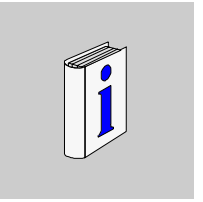
About the Book



At a Glance

Document Scope

This user guide contains the information required to install an IP67 modular I/O splitter box.

It has been designed to help system installers become rapidly familiar with the system, while optimizing the system's features with the most advanced technology available.

Installing the splitter box requires prior knowledge of the relevant communication protocol and should only be carried out 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. It details characteristics which are common to the whole Advantys FTM range and is not dependent on the selected communication protocol.

The following chapters, from the section on "Network interface", are specific to the communication 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
Network interface	Wiring the splitter box on the network Communication protocol review 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
Glossary	Acronyms Definitions.

Related Documents

Title of Documentation	Reference Number
Instruction sheet for the FTM 1DN10 coupling device	1693684
Instruction sheet for the FTM 1D• / FTM 1A• splitter box	1693687

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 DeviceNet range of IP67 modular I/O splitter boxes.

Note: The information in this manual is primarily intended for users with some practical knowledge of the CAN standard applied to the DeviceNet field bus. DeviceNet 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.odva.org.

What's in this Chapter?

This chapter contains the following topics:

Topic	Page
System Architecture	12
Overview of the Product Range	15
Presentation of the Accessories Range	18
Use of the Diagnostics Function of Pin 2	21

System Architecture

At a Glance

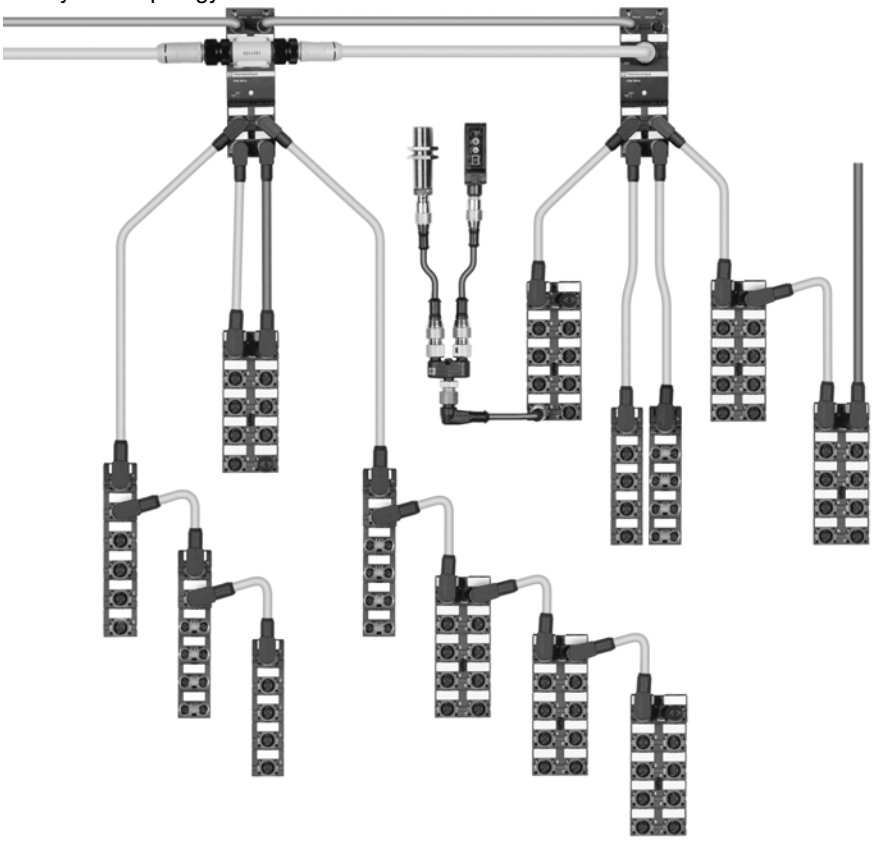
The Advantys FTM modular system enables you to connect a variable number of input/output splitter boxes, using a single communication interface (field bus module).

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

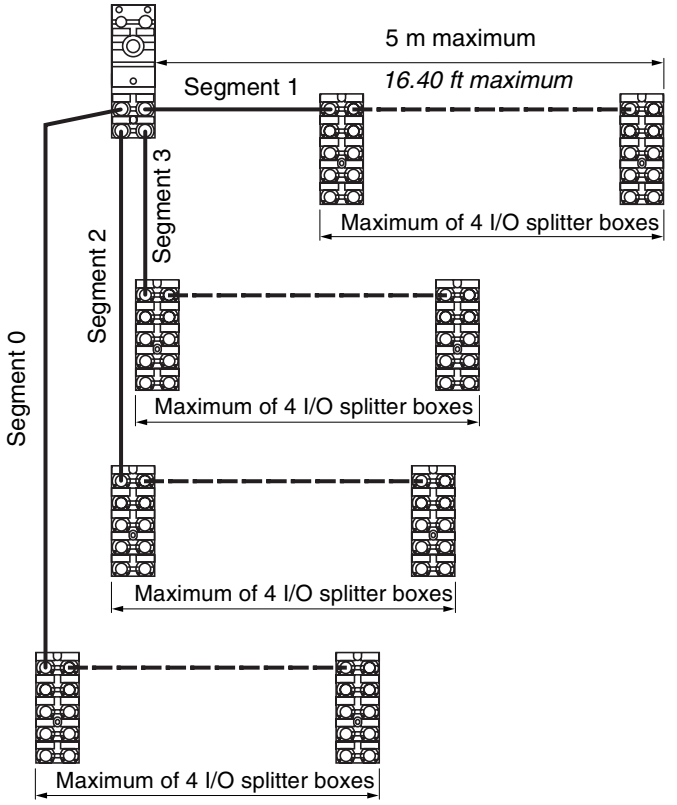
The system topology is a star/line architecture.



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	-

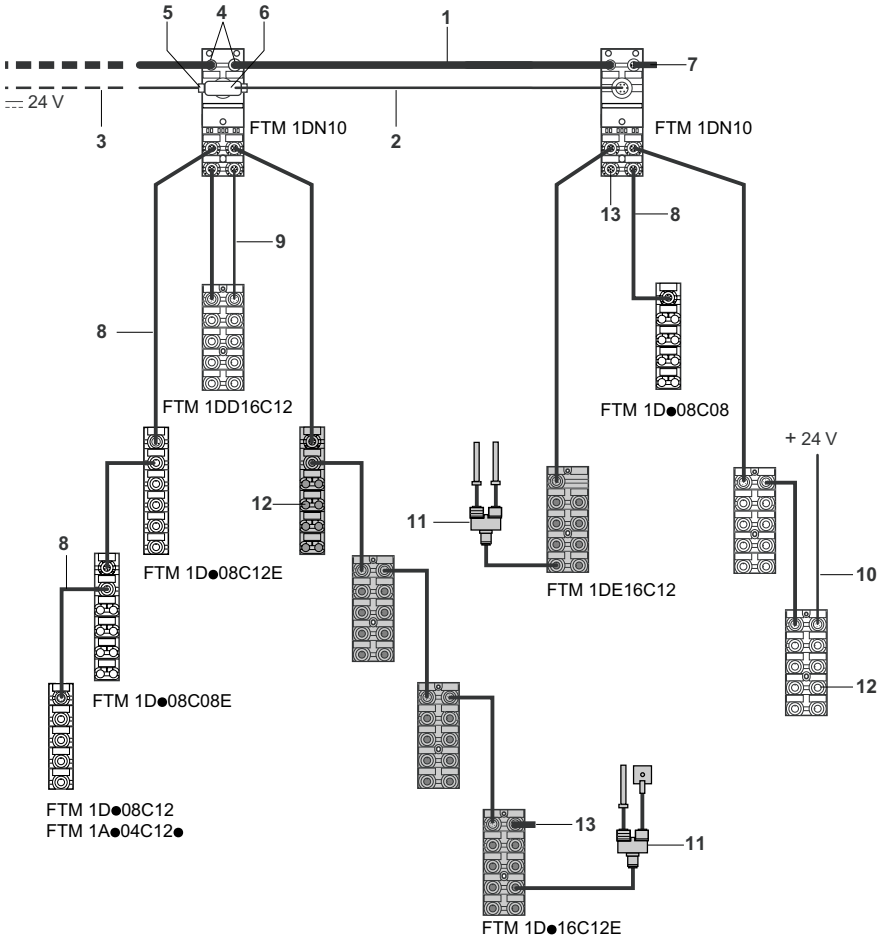
The references for analog splitter boxes are listed in the following table:

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 modules. 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, at both 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 5-pin connectors for DeviceNet bus cables (encoding A).
	FTX CN12F5	Female M12 5-pin connectors for DeviceNet 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 elbow connectors, 6 pin 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.
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)*.
11	FTX CY1208	Y-connector for connecting 2 M8-type connectors to an M12 connector.
	FTX CY1212	Y-connector for connecting 2 M12-type connectors to an M12 connector.

Element	Reference	Function
12	FTX CM08B	Sealing plugs for M8-type connectors.
	FTX CM12B	Sealing plugs for M12-type connectors.
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

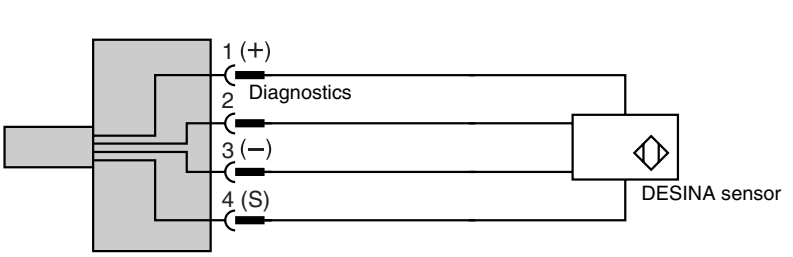
The choice between the sensor input function or diagnostics input function at pin 2 level is made for each channel and each setting, when configuring the splitter box.

Fault Display

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

Example 1

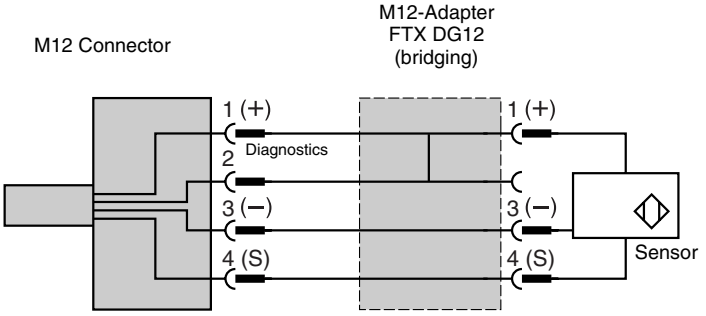
Connecting a sensor fitted with a diagnostics function:



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?

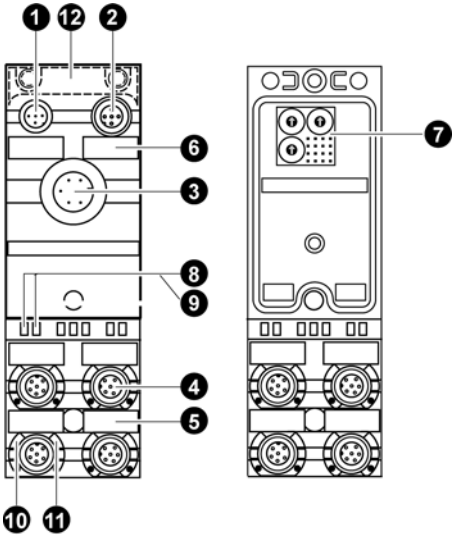
This chapter contains the following topics:

Topic	Page
Overview	24
Installing the Coupling Device	27
Grounding	29
EMC Compatibility	31
Installing a Splitter Box	34

Overview

Module Description

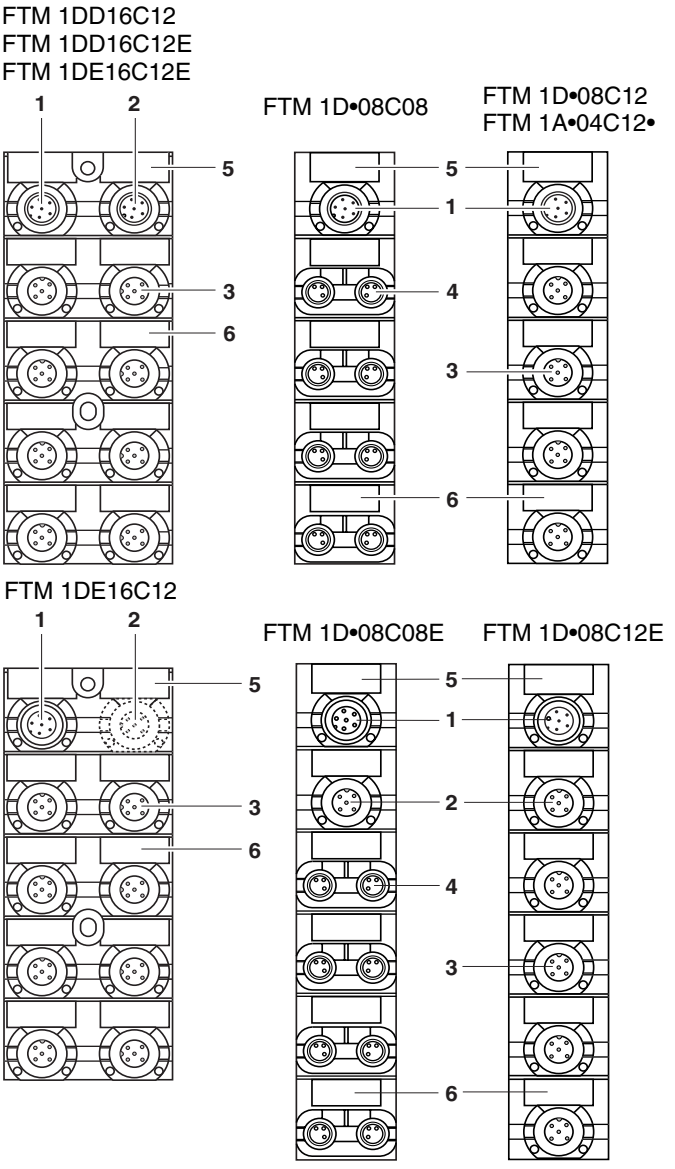
This is the front view of a coupling device (a coupling device closed on the left, open on the right):



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.

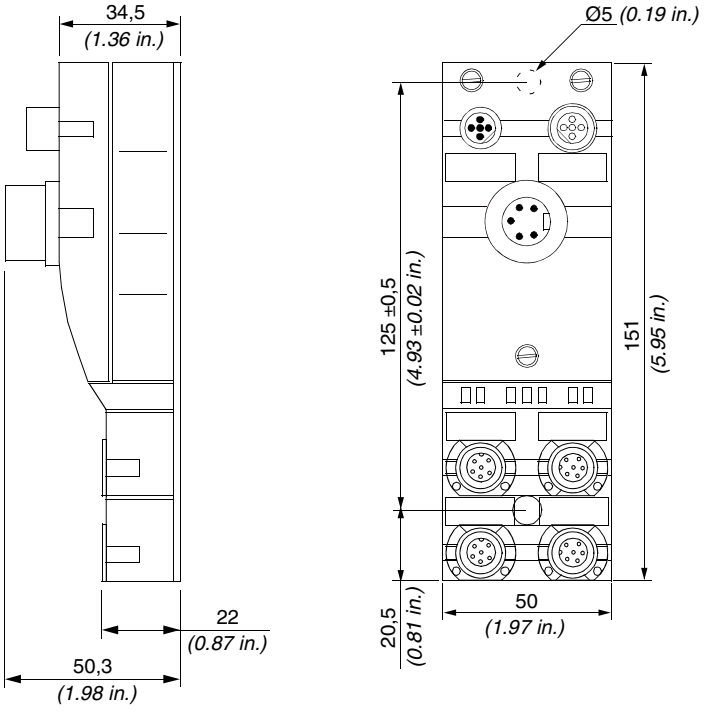
Installing the Coupling Device

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 could cause poor sealing.

Operating Mode

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 Distributor, p. 59*
5	*Grounding, p. 29*
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:

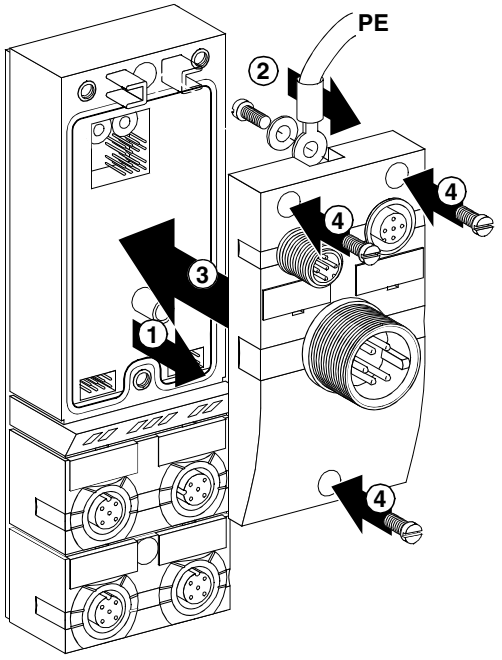
- properly fit all connectors with cables or sealing plugs and tighten,
- install cover onto coupling device and tighten captive screws to specified torque.

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 1.5mm^2 *(AWG18, AWG16)* and length ≤ 3m *(9.84ft)*. 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 ground 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. 31*.

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 *(16...18 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

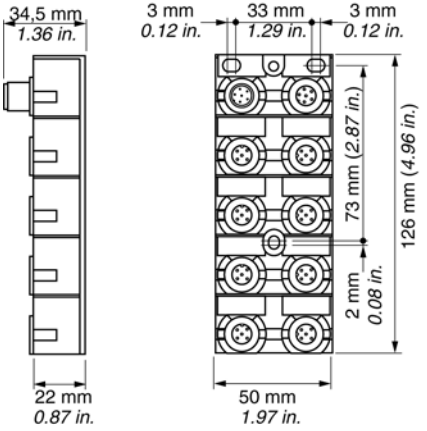
The splitter boxes are mounted using two 4 mm *(0.15 in.)* diameter screws and two washers. The tightening torque is 2 Nm *(17.6 lb-in)*.

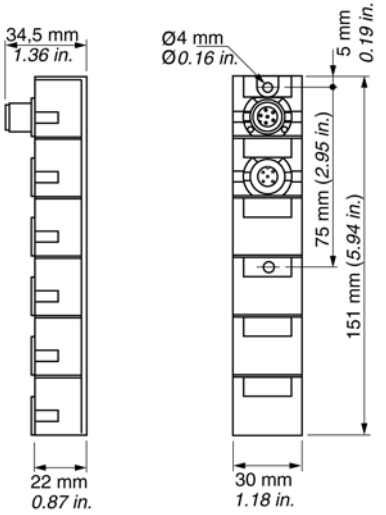
Dimensions of Extendable Splitter Boxes

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

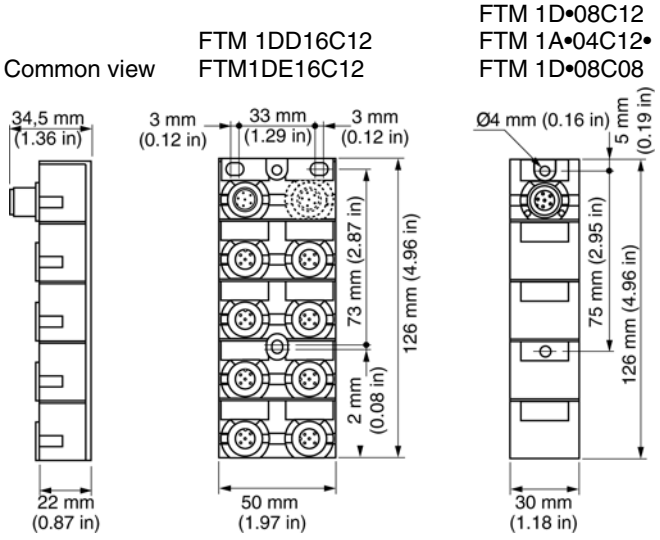
For IP67 protection:

- 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. 36*).
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:

Topic	Page
FTM Splitter box Environment Properties	38
Electrical Properties of Module	39
How to Connect the Power Supply	40
Internal Bus Connection	43

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 m *(0 ft)*...2000 m *(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

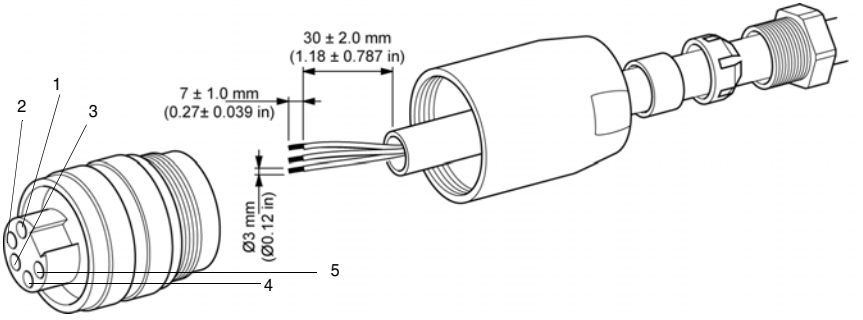
RISK OF UNINTENDED EQUIPMENT OPERATION

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.

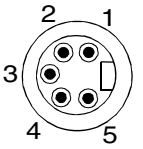
Assembling the Power Supply Cable

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

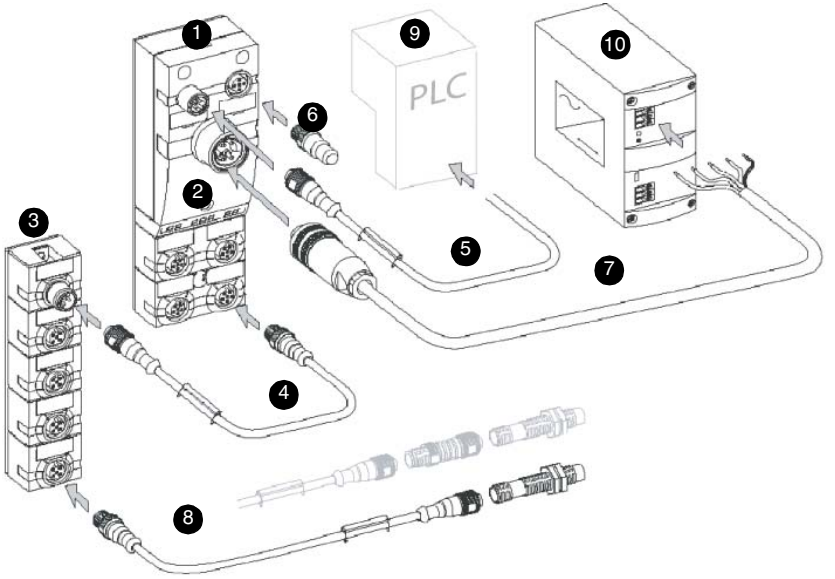
Internal Bus Connection

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:

Topic	Page
Electrical Properties of Discrete Splitter Boxes	46
Connection of Actuators and Sensors to Discrete Splitter Boxes	47
Electrical Characteristics of Analog Splitter Boxes	49
Connection of Actuators and Sensors to Analog Splitter Boxes	50

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.

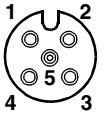
Failure to follow these instructions can result in death, serious injury, or equipment damage.

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

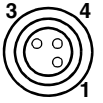
The following diagram shows the front view of a 5-pin M12 connector and the convention for numbering the pins:



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.

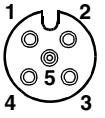
Failure to follow these instructions can result in death, serious injury, or equipment damage.

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

DeviceNet Network Interface

5

At a Glance

Description

This chapter provides theoretical elements for DeviceNet operations.

What's in this Chapter?

This chapter contains the following sections:

Section	Topic	Page
5.1	Cabling on the DeviceNet Bus	53
5.2	General Principles	61
5.3	Behavior	68

5.1 Cabling on the DeviceNet Bus

Presentation

Introduction

The following section describes the elements required for wiring the Advantys FTM coupling devices and splitter boxes to the DeviceNet bus.

What's in this Section?

This section contains the following topics:

Topic	Page
Choice of System Cables	54
Connecting the Field Bus	55
Configuring the Address and Speed of the Distributor	59

Choice of System Cables

The Different Cables

Depending on the requirements of the different applications, the system wiring at the field bus end can be performed using:

- a round cable,
- a flat grey cable specific to the DeviceNet system.

Two electrical criteria are important when choosing a suitable transmission cable:

- Ohmic resistance (cable section), due to the auxiliary power supply
- Transmission characteristics: Impedance of 121 Ohms (1/4, 1/2W or more)

Structure of Cable Systems for DeviceNet

The various cables always comprise 4 wires. The transmission technique means that the cables must be shielded

An additional auxiliary power supply is needed for the actuators.

Diagrams 3-4 (DN round cable) and 3-5 (DN profile line) show the composition of the cables.

The maximum admissible current for the cable system (DeviceNet and ODVA specification, chapter 10) is 9 A!

Consequently, all other devices (e.g. 7/8" connector) are sized for a maximum current of 9 A!

Connecting the Field Bus

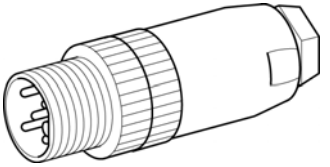
Description

The splitter box can either be in the middle of the chain connection or at line end.

The field bus is connected via a 5-pin M12 connector.

Illustration of a Mini-style M12 Connector

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

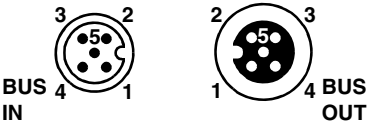


Bus Connector Pin Assignment.

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	Shielding	Bus shielding
2	V+	24 VDC power supply for coupling device
3	V-	0 VDC power supply for coupling device
4	CAN_H	CAN_High bus line
5	CAN_L	CAN_Low bus line

Note: Pin 1 is connected to the splitter box ground terminal.

⚠ WARNING

RISK OF NON-COMPLIANCE WITH IP67

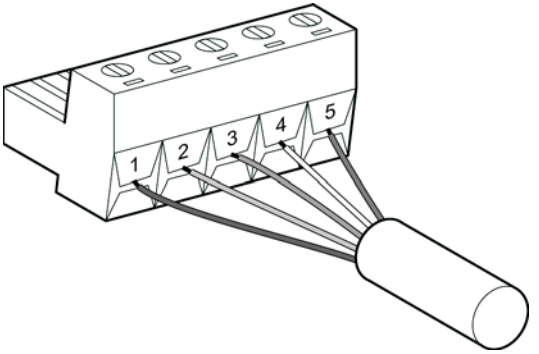
For IP67 protection:

- 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.

Illustration of an Open-style Connector

The following diagram shows an Open-style connector with the wire assignment:



Element	Function	Wire color
1	V-	Black
2	CAN_L	Blue
3	Shielding	Shielding
4	CAN_H	White
5	V+	Red

System Wiring

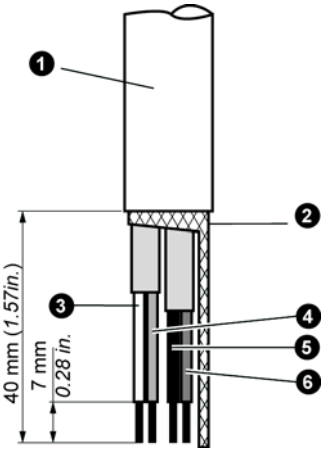
Depending on the requirements of the different applications, the system wiring at the field bus end can be performed using a round cable.

Note: Two electrical criteria are important when choosing a suitable transmission cable:
- transmission characteristics
- impedance of 121Ω (1/4, 1/2 W or more).

Schneider Electric offers a wide range of pre-manufactured and round cables.

The various cables always comprise 4 wires. The transmission technique means that the cables must be shielded

The following diagram shows the composition of the cable.

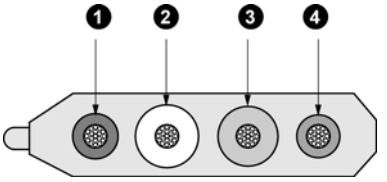


Element	Function
1	Cable sheath
2	Shielding strip
3	CAN_H (white)
4	CAN_L (blue)
5	V+ wire (red)
6	V- wire (black)

Ribbon Cables

The DeviceNet products with direct connection for ribbon cables have a geometric coding. This constitutes an absolute protection from pole inversion.

The following diagram shows a front view of the ribbon cables:



Element	Function
1	0 V
2	CAN_H
3	CAN_L
4	+24 V

Operating mode

Follow the steps below:

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

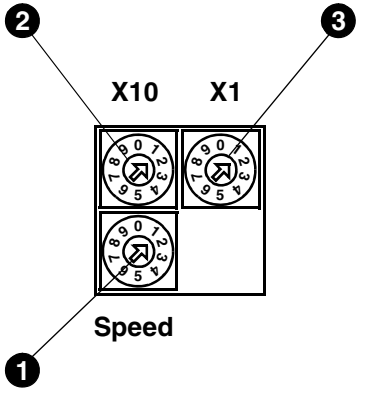
Configuring the Address and Speed of the Distributor

Operating mode

Follow the steps 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.

Rotary Switches - Illustration



Element	Function
1	Transmission speed selector switch
2	Selector switch Node-ID x 10
3	Selector switch Node-ID x 1

Assignment of the Address on the Network

The address is configured using two specially designed rotary switches. Addresses can be configured from 1 to 99. Address 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.

Adjustment of the Transmission Speed

The transmission speed is configured using a rotary switch.

The following transmission speeds are possible:

Switch position	Transmission Speed
0, 3, 4, 5, 6, 7, 8, 9.	125 Kbits/s
1	250 Kbits/s
2	500 Kbits/s

Note: When adjusting the transmission speed, ensure that each network element is set to the same speed.
The configured transmission speed is registered at power-up. It cannot be changed without removing the cover.

5.2 General Principles

At a Glance

Introduction

This section addresses the general principles for operating and using the DeviceNet field bus.

What's in this Section?

This section contains the following topics:

Topic	Page
DeviceNet Description	62
Transmission Modes	64
Bus Load and Reaction Time in "Polling" Operating Mode	65
General Characteristics of the DeviceNet System	67

DeviceNet Description

Type of Network

DeviceNet is a Low-End open network that enables the direct connection between simple industrial devices such as detectors and power break switches (actuators), as well as more sophisticated devices such as barcode readers and frequency converters with control systems (PLCs).

DeviceNet Product Certification

The DeviceNet systems is based on the widely used CAN (Controller Area Network) technology - OSI layers 1 and 2 – and in compliance with international standards EN50325 and IEC62026. It uses standard chips that are also used in various industrial applications throughout the world, for example in the automotive industry.

Below are two DeviceNet logos but only one of them is certified.

Certified logo

Uncertified logo

Note: The uncertified DeviceNet logo is very similar to the certified one.
Only products with the following logo are DeviceNet certified.
DeviceNet certified logo:

Network Heat Resistance

Due to its robust protocol, DeviceNet differs from other systems through its excellent resistance to high temperatures and interference fields. Moreover, it displays exceptionally resistant network operation.

Adaptability

The DeviceNet (CAN) system is suited to the industrial automation requirements.

Implementation Time

The Plug&Play connection technique and the network cable power supply (potentially with the auxiliary power supply cable) reduces the time needed for implementation and maintenance.

DeviceNet Application Layer

The DeviceNet system application layer uses the 'Producer-Consumer' process thus enabling very efficient data transfer. Unlike the conventional "Source-Target" model, this efficiency is obtained using Multicast and Broadcast transfers, Poll and Strobe processes, as well as sending controlled information according to time and event (change-of-state) parameters.

DeviceNet Communication Types

Explanations (ex.) concerning the DeviceNet types of communication for input/output data:

- Polling : the master unit ("scanner") sends output data on a cyclical basis to the corresponding units and receives input data in the response message.
- Change of State (COS): The messages are sent as soon as their content has been modified. In this case, only process image modifications are transmitted.
- Cyclic: the units send data autonomously after a determined cycle length.
- Strobed: the scanner requests data from all units with a 'Broadcast' message.

Optimized Messages

Up to 8 bytes of useful data per message and fragmentation of larger messages provide ideal conditions for optimizing the reception of data and the diagnostics of simple or intelligent field devices.

Transmission Speed

Three transmission speeds are possible for different bus lengths: 125, 250 and 500 Kbits/s.

By using the bus bandwidth and despite a heavy load on the bus, DeviceNet manages very short response times, particularly in 'Change of State' mode.

Diagnostics Functions

Schneider Electric Industries SAS DeviceNet diagnostics functions enable the rapid location of system errors or faults. The diagnostics messages transit on the bus and are grouped by the master. The state of the network link, splitter box, inputs and outputs and power supply are indicated by lights or LEDs (in compliance with the standards).

Wiring Used

DeviceNet is a simple and inexpensive wiring system made up of one 4-wire cable: One pair for data transfer and one pair to conduct the auxiliary power to the detectors over a distance of up to 500 m *(1640.42 ft)*.

A > 500 m *(1640.42 ft)* system extension is possible but requires the installation of repeaters.

Transmission Modes

Description

The DeviceNet system application layer uses the 'Producer-Consumer' process thus enabling very efficient data transfer.

Unlike the conventional "Source-Target" model, this efficiency is obtained using the following transmission modes:

- Strobed,
- Change of State,
- Cyclic,
- Polling.

⚠ CAUTION

RISK OF SYSTEM OVERLOAD

There is a risk of system overload when you use analog inputs in COS mode. In this case, use the "delta" settings of the analog input channels to reduce the load on the bus.

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

Strobed

The scanner requests data from all units with a 'Broadcast' message.

Change of State

Sending information is controlled according to time and event parameters.

The messages are sent only if the I/O image has been modified.

Cyclic

Transmission Multicast ***and*** Broadcast modes

The units send data autonomously after a determined cycle length.

Cyclic data transfer

The devices transfer I/O data according to a time base that can be configured by the user. This mode is particularly suitable for the use of analog inputs.

Polling

The master unit ("scanner") sends output data on a cyclical basis to the corresponding units and receives input data in the response message.

Poll Command

The I/O message is directly addressed to a slave (point by point). If the device has outputs, the master must send a Poll command to each "Poll" slave, which contains the output data for the slave.

Poll Response

The "polled" slave returns its input data (if they exist).

Bus Load and Reaction Time in "Polling" Operating Mode

Example

The table below shows the load of the bus with 36 bytes of input data and 4 bytes of output data for the Advantys FTM system.

Transmission Speed (Kbits/s)	Maximum duration between two fragmented T_{Msg} messages (ms)	Response time after T_{Rq} request (ms)	Total duration of T_{total} telegram (ms)	Bus load per FTM coupling device	Recommended minimum duration for T_{Poll} polling (ms)
125	1.0	4.8	9.8	53%	5
250	0.7	4.7	8.2	36%	5
500	0.2	4.6	5.6	20%	5

Owing to the large amount of data in the Advantys FTM system (approx.. 10 bytes per FTM I/O splitter box), the bus load of the overall system must be considered. By taking this criterion into account, the polling duration can be set to 5 ms minimum, in order to obtain a relatively quick response time for the input data. For most of the control units, the default setting is 10 ms. When the last fragment has been received and the interrogation time has expired, the PLC sends a new request to the slave.

The input statuses cannot be sent to the PLC if the duration of the input signal is less than the sum of the T_{total} message and T_{Poll} polling durations.

Calculating the Total Duration of a Message

Follow the steps below:

Step	Action
1	To do this, you must first determine the number of fragments in the I/O message.
2	The data byte figure is divided by 7. If this number cannot be divided without leaving a remainder, add 1. ***Example*** 36 bytes produce 6 fragments
3	The total duration of the message is the result of the number of fragments minus one fragment multiplied by T_{Msg}, added to T_{Rq}.

Example

For a speed of 125 Kbits/s, we obtain:T_{total} = (1.0 ms * 5 + 4.8 ms) = 9.8 ms

Adapting the Polling Duration

A system with a polling duration of 5 ms at 125 Kbits/s is only possible for a coupling device with a bus load of about 53%.

The polling duration must be increased in relation to the size of the system, if a higher transmission speed cannot be selected.

For point-to-point communication with the network master, total polling time can be estimated as T_{total} x3.

For further information on how to optimize communication, see the documentation of the master concerned.

General Characteristics of the DeviceNet System

Description

Topology	Tree structure
Transmission line	Cable with 4 twisted and shielded wires, with separate data (white & blue) and power supply (black and red) wires
Cable length	Main line max. 500 m *(1640.42 ft)*, branch cables max. 6 m *(19.68 ft)*
Number of units on the bus	max. 64
Number of I/O points	Depending on control unit
Addresses	One Mac-ID between 0 and 63 per device
Addressing	Mac-ID, serial number (32 bits)
Transmission speed	Depending on the length (max. 500 Kbits/s) ● 500 Kbits/s up to 100 m *(328.08 ft)* (Thick –Cable) ● 250 Kbits/s up to 250 m *(820.21 ft)* (Thick –Cable) ● 125 Kbits/s up to 500 m *(1640.42 ft)* (Thick –Cable) Max length of the main line with repeaters: 3 km *(9842.49 ft)*
Useful data	8 bytes per message
Terminal resistance	121 Ω,at each end of the data line
Error detection	Identification of erroneous messages, automatic repetition
Electrical	24 VDC tolerance (global) +/- 4%

5.3 Behavior

Presentation

Introduction

This section addresses the different behavior patterns of the Advantys FTM DeviceNet splitter box.

What's in this Section?

This section contains the following topics:

Topic	Page
Behavior at Power-up	69
Behavior for Communication Error	70
Behavior in the Case of Internal Bus Errors	71
Saving and Restoring Parameters	72

Behavior at Power-up

Description

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 communicate on the DeviceNet network.

If there is no back-up configuration, the FTM coupling device initializes the data with the default parameters. When a save has been carried out, the saved parameters are applied during initialization.

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.

Behavior for Communication Error

Description

In case of communication error the fallback values are applied until the next write on outputs after disappearance of the communication error.

For fallback modes and values, see *Discrete Outputs, p. 76* and *Analog Outputs, p. 78*.

Behavior in the Case of Internal Bus Errors

Description

If an error occurs on the internal bus, the FTM switches to fault mode and stops communicating on the network. Input data can no longer be read and output data can no longer be written.

The last input and output values are frozen.

The fallback values are applied to the outputs.

Saving and 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.

Saving Parameters

The save is controlled by a read access (Set service) with value 1 in attribute 14H of instance 1 of class 64H, user parameter settings.

Restoring Factory Settings

The restoration is controlled by a read access (Set service) with value 1 in attribute 15H of instance 1 of class 64H, user setting delete.

While writing or deleting saved parameters, the node no longer processes communication on the DeviceNet bus. During this operation no message transmitted to the slave is taken into account. The outputs are maintained in their current state and the inputs are not updated.

⚠ WARNING

RISK OF UNINTENDED EQUIPMENT OPERATION

User must allow for communication delays when writing or deleting parameters.

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

Note: With the Allen-Bradley RSNetWorx software, before saving or restoring data, you must delete the FTM from the PLC's Scanlist to prevent the FTM from going into error state.

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:

Topic	Page
Application-Specific Functions Description	74
Discrete I/Os description	75
Description of Analog I/Os	77
Measurement Ranges and Scales	79
Splitter box Channel Types	82

Application-Specific Functions Description

Available Types of Channels

The Advantys FTM range offers a wide selection of discrete and analog I/O splitter boxes. The following chapter describes the operation of the I/Os and configuration data.

Exchange Methods of Available Data

There are two methods to exchange I/O data.

First method

The first method involves using an instance of the "Assembly" object (class 4) that enables implicit I/O exchange with the PLC memory.

The instances of the Assembly object are detailed in the "Object Dictionary" chapter.

The exchange is then carried out following the configured transmission mode (Polling, Cyclic, Change Of State, etc.).

The coupling device's Assembly object has two instances for input and output exchange. For example:

- The 64H instance of class 4, (Assembly object) includes the B attributes (inputs + diagnostics) of the class 65H instances (one instance is created per splitter box).
- The 65H instance of class 4, (Assembly object) includes the C attributes (outputs) of the class 65H instances (one instance is created per splitter box).

Byte	Data origins				Description
	Module	Class	Instance	Attribute	
0	Communication interface	64H	1H	6	Voltage diagnostics
1					
2		64H	1H	8	Short-circuit diagnostics
3		No internal return			General state of product
4	Splitter box 1	65H	1H	BH	Input + diagnostics data for the first splitter box (length = n bytes)
4+n	Splitter box 2	65H	2H	BH	Input + diagnostics data for the second splitter box (length = p bytes)
4+n+p	Splitter box 3	65H	3H	BH	Input + diagnostics data for the third splitter box (length = q bytes)
4+n+p+q	...				

Second method

The second method consists in reading and writing, by means of a request, in the objects containing the I/O values (attributes of class 65H, instance 1H and the following instances).

Discrete I/Os description

Configurable channels

The configurable splitter box discrete channels can be used as inputs or outputs. (They are configured as inputs by default).

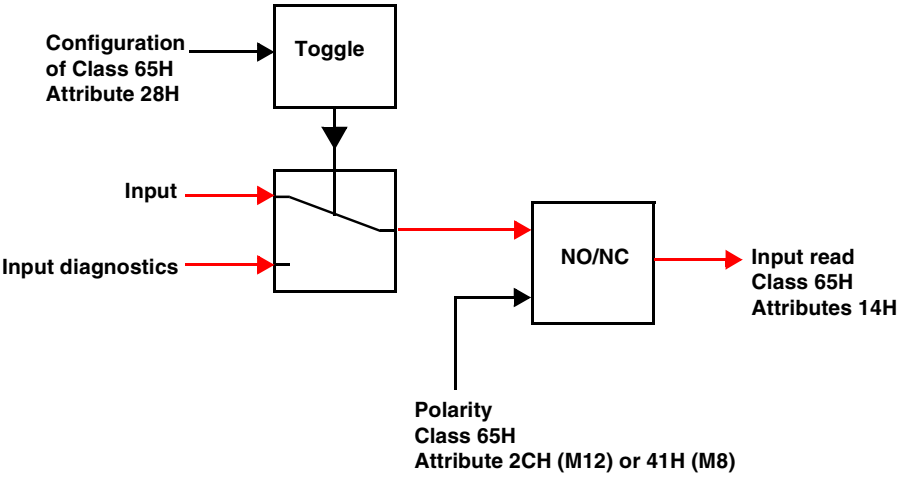
Channels 10 to 17 of discrete splitter boxes (pin 2 on M12 connectors) can be configured as "diagnostics inputs" for monitoring sensors or actuators equipped with a diagnostics function (DESINA).

Discrete Inputs

The inputs can be reversed in order to be used in NO or NC.

Channels 10 to 17 (pin 2 of M12 connectors) can be configured as "diagnostics inputs".

The status read on inputs is defined as follows:



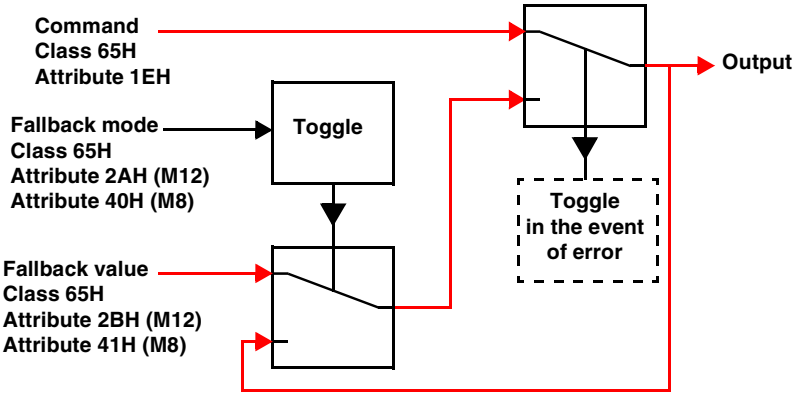
Channels 00 to 07 are configured as "NO input" by default (no reversal).

Channels 10 to 17 are configured as "diagnostics input" by default (no reversal).

Discrete Outputs

In the event of communication errors with the bus master, the FTM assigns the user-configured status to the outputs:

- maintaining the last value,
- fallback to 0 (mode by default),
- fallback to 1

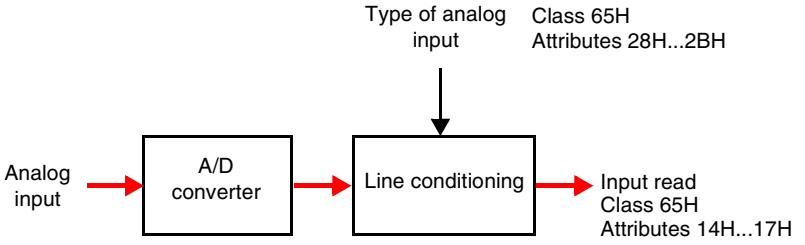


Description of Analog I/Os

Analog inputs

Analog inputs are read by 16 bit words.

The status read on inputs is defined as follows:

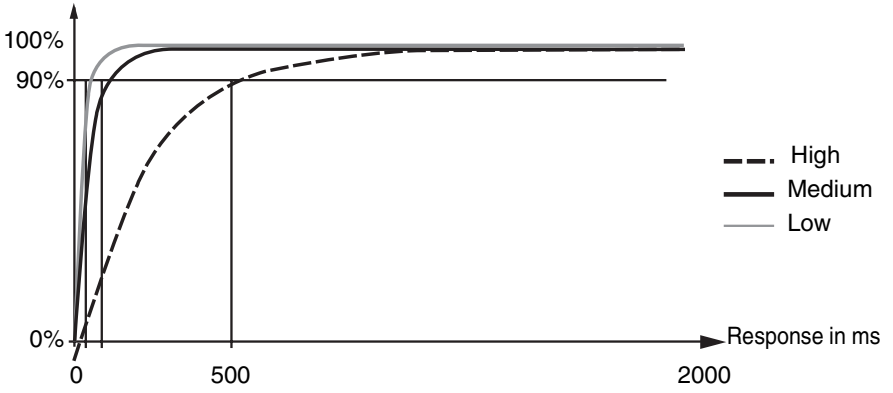


Smoothing the Input Value

The analog signal can be pre-filtered in the device, to reduce temporary measurement variations for example.

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 module in relation to the response time on an active channel.



Using Delta

The delta value is used to define a deadband, within which input signal value changes will not be reported. This is used to avoid a bus overload if data is transmitted for a change in value.

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

Example

If the final measurement value was 1000 points. by then adjusting the delta value to 100, a new measurement value will only be sent if less than 900 or greater than 1100.

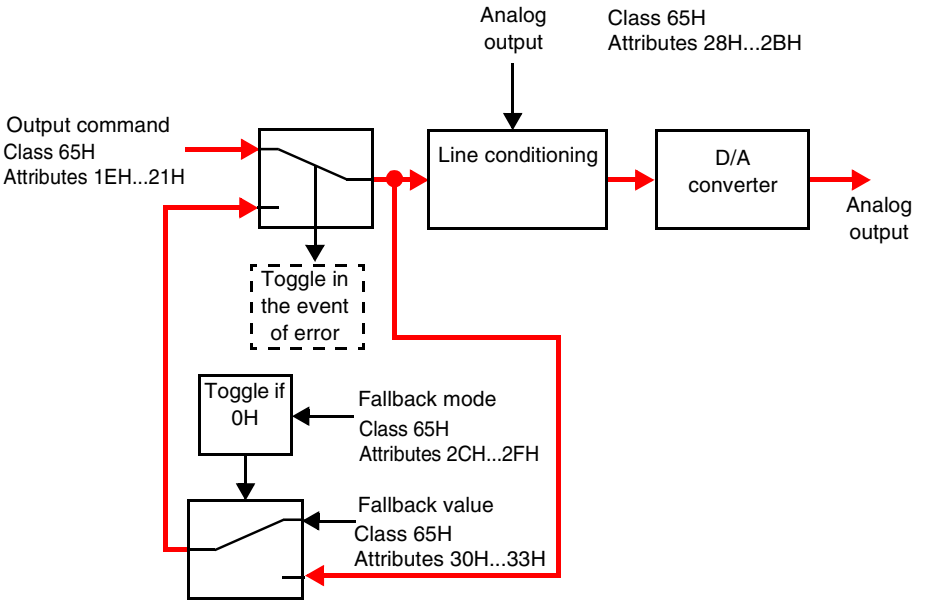
The delta value must be between 0 and 32 767.

Analog Outputs

In the event of communication errors with the bus master, the splitter box assigns the user-configured status to the outputs:

- maintaining the last value,
- Fallback to a preset value

The status applied on the output is defined as follows:



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...32 767	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.

Splitter box Channel Types

Description The table below shows the types of channels available for each splitter box:

Splitter box	Discrete Inputs	Configurable discrete channels	Analog inputs	Analog Outputs
FTM 1DE16C12•	00...07 10...17	-	-	-
FTM 1DE08C12•	00...03 10...17	-	-	-
FTM 1DE08C08•	00...07 -	-	-	-
FTM 1DD16C12•	-	00...07 10...17	-	-
FTM 1DD08C12•	-	00...03 10...17	-	-
FTM 1DD08C08•	-	00...07	-	-
FTM 1AE04C12T	-	-	4 (Voltage)	-
FTM 1AE04C12C	-	-	4 (Current)	-
FTM 1AS04C12T	-	-	-	4 (Voltage)
FTM 1AS04C12C	-	-	-	4 (Current)

Software Installation

7

At a Glance

Introduction

This chapter provides all necessary elements for software installation of Advantys FTB and FTM splitter boxes.

What's in this Chapter?

This chapter contains the following topics:

Topic	Page
Possible Configurations	84
Step-by-Sep Procedure	85
Configuring the Splitter Boxes Associated to the FTM 1DN10 Coupling Device	88

Possible Configurations

Description

Generally, configuration is carried out using a help software tool like the Allen-Bradley RSNetWorx during configuration.

However, the parameters can also be modified from the user program via explicit requests directed to the attributes of class 65H containing the configuration words. For further information on this subject, see the "Object Dictionary" chapter.

Step-by-Sep Procedure

Description

The Advantys FTM splitter box is installed on the field bus using the DeviceNet scanner. The scanner searches for DeviceNet units on the network. To ensure correct recognition, the EDS files of the Advantys FTM splitter boxes should be placed in the scanner software beforehand.

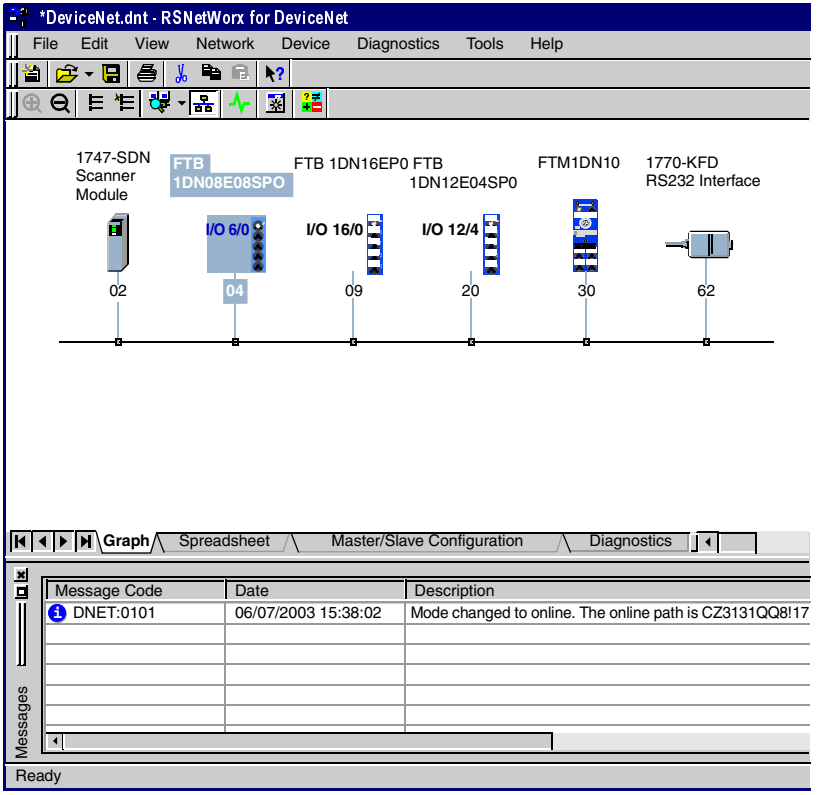
If devices were addressed to the bus using a software, they must always be connected to the bus in a sequential manner since they all have the same MAC-ID by default!

Once the system is completely configured and bus communication is activated, other devices can be added to the bus provided that their MAC-ID (address) and transmission speed are correctly configured.

The typical errors that occur during installation are: Bus line damage, incorrect transmission speed, twice assigned MAC-ID, inversion of CAN_H and CAN_L on the bus line, no power supply (back up power supply), bus termination incorrect, No EDS file or EDS file errors.

Note: The units with the same MAC-ID will not complete the MAC-ID test. At the end of the self-test, the NS LED lights up red.
Each device type has its own EDS file (*.eds) + icon (*.ico). These files are located on the FTX ES0• CD or at http://www.telemecanique.com.

Example of Scanlist using the Allen-Bradley RSNetWorx software:



Operating mode

Installing with Allen-Bradley SLC 5/03 software, KFD-Box 1770-KFD (RSNetWorx for DN) and an Allen-Bradley 1747-SDN scanner:

Step	Action
1	Connect one or several devices to the DeviceNet bus (make sure its composition is appropriate for the field bus).
2	Apply the power supply voltage to the units on the bus (check the voltage beforehand).
3	The scanner will first conduct a self-test and display the corresponding status messages (on the display: "80"). After the scanner starts up, "00" and "75" flash alternately on the display. The status of the scanner is also shown by 2 LEDs located on the scanner; these two LEDs indicate the status of the DeviceNet bus (Ok or NOK) and the status of the module (scanner error after start-up without module unit= green, Net = flashing green). When there are units on the bus, the LEDs remain unchanged but the "00" and "76" messages blink alternately on the display.
4	At this time, the FTM coupling devices also show their status via the bus LEDs (MS = green and NS = flashing green).
5	Connect the KFD-Box to the field bus and the PC and launch the RSNetWorx software tool. In the RSNetworx task bar, press the "Online" button and validate certain safety messages; the program will then start scanning the network via theKFD-Box (it must be defined beforehand that the network will be scanned by the KFD-box). At this time all the units that are correctly connected to the bus are displayed!
6	Ensure that all the bus units have been detected and are correctly registered in the scanner's Scan list.
7	Click on the "Register Scanlist" button and confirm with the "Download"button. In the new Windows window, press the ">>" button then "open" and download in the scanner's Scan list.
8	All the modules are now registered in the scanner's Scan list (this is also indicated by the status LEDs of the FTp 1DNppp and scanner: FTp 1DNppp = green MS and NS, Scanner = module and green Net) and the module data can be accessed using the PLC depending on the established Scan list.

Step	Action
1	Change the EDS files and icons using the FTX ES0• CD-Rom.
2	Connect the FTM coupling device to the DeviceNet Bus.
3	Switch on the system.
4	Configure the products.

Configuring the Splitter Boxes Associated to the FTM 1DN10 Coupling Device

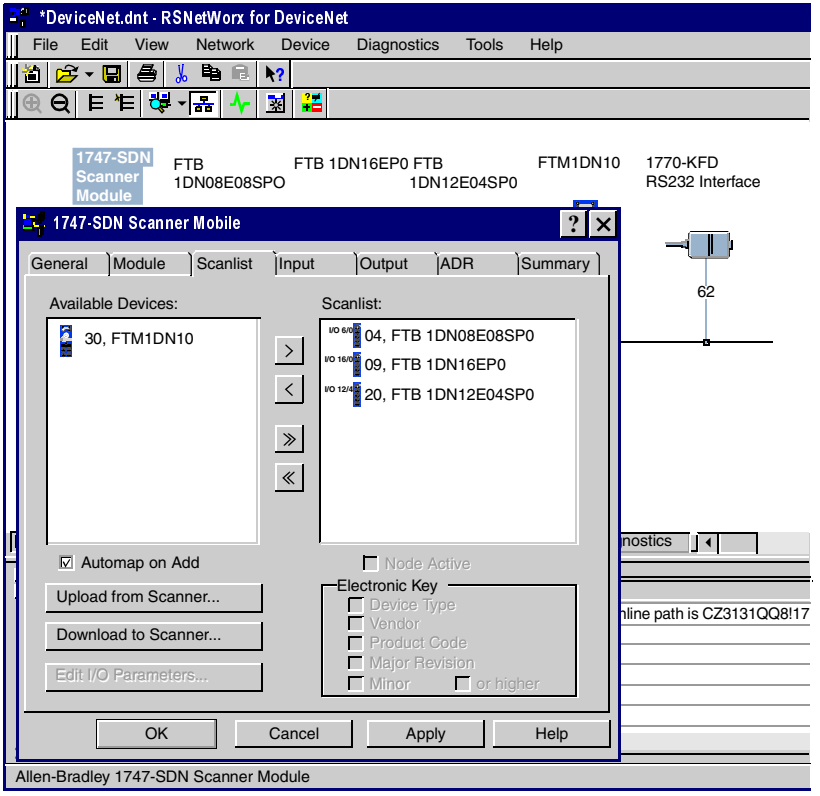
Operating mode

After installing the network as previously indicated, the parameters of the splitter boxes on the network must then be configured.

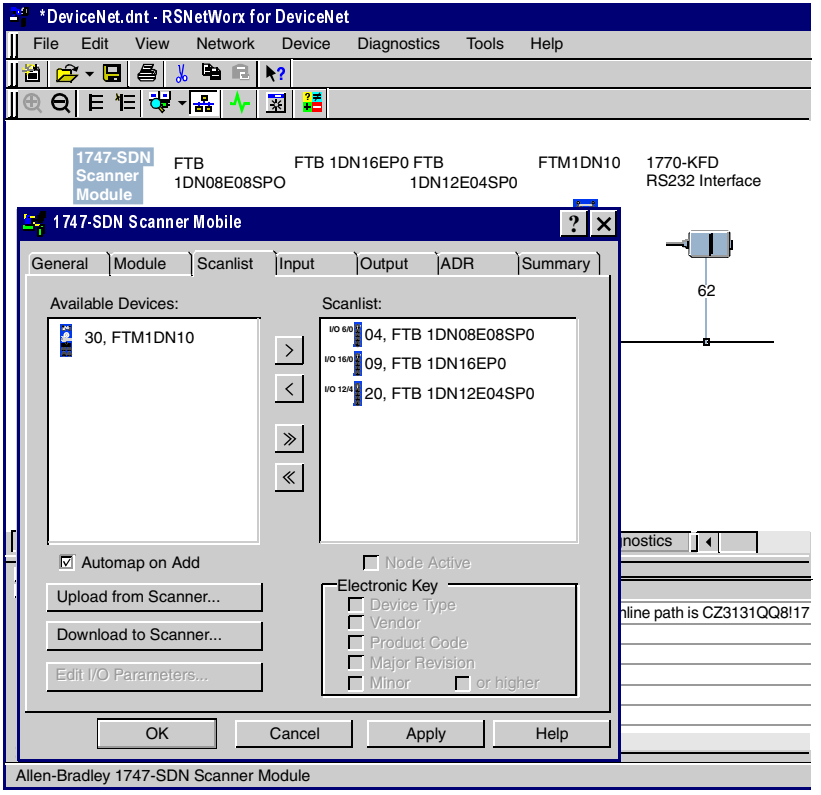
The parameters are acknowledged only after their validation.

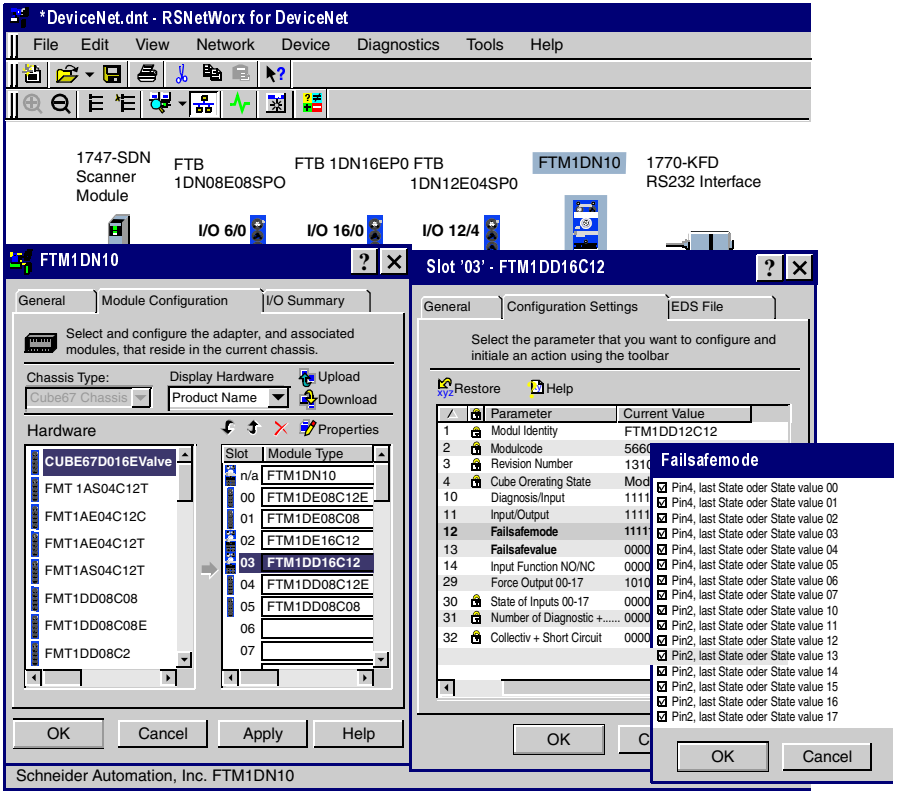
Before saving data, delete the coupling device from the Scan list of your PLC to prevent it from displaying an error. The coupling device will not respond to any request from the master during the writing phase.

Follow the steps below:

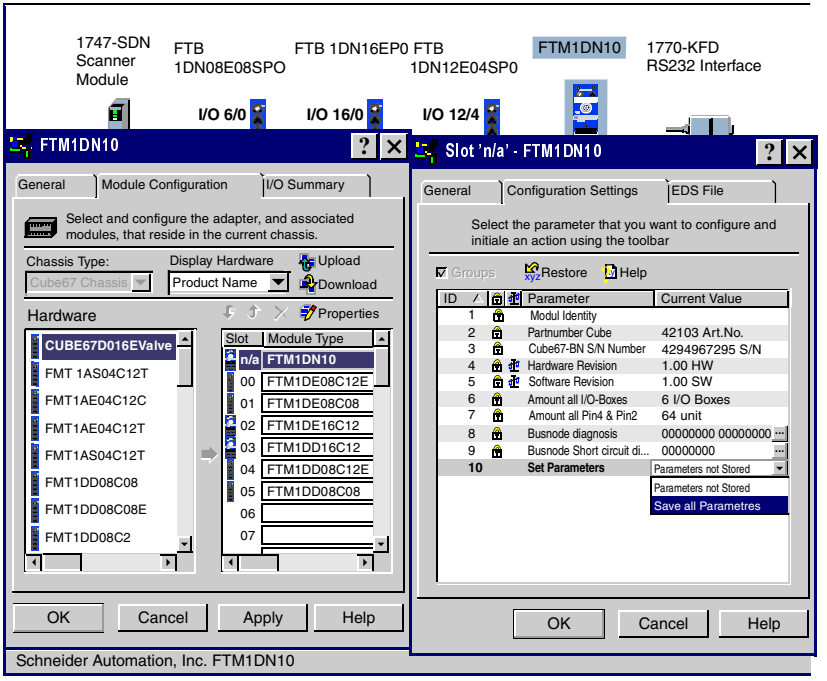
Step	Action
1	Remove the FTM 1DN10 module from the scanlist. 

Step	Action
2	Click Ok.

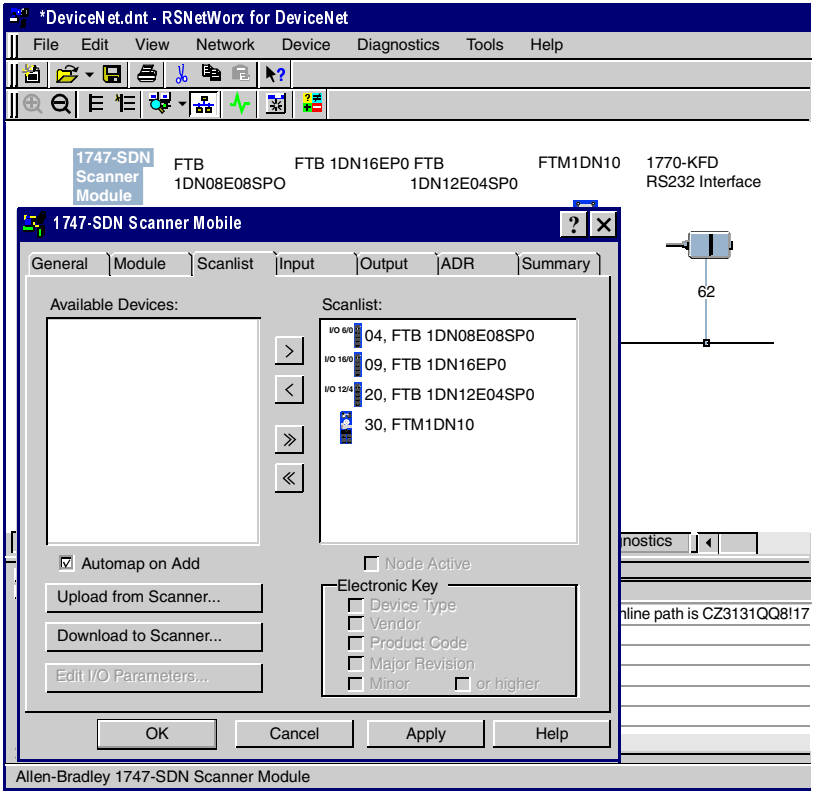


Step	Action
3	• Declare all the splitter boxes connected to the coupling device following the ramification order. • Select the splitter box to be configured. • In the "Advanced parameters" tab, modify the parameters. ***Example*** • Click "Failsafe mode". • Check the fallback values desired for each channel. • Click Ok. 

Step	Action
4	In the drop-down list to the right of the "Set parameters" parameter, select "Save all Parameters" and click OK.



Step	Action
5	Replace the FTM coupling device in the scanlist.



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,
- Software.

What's in this Chapter?

This chapter contains the following topics:

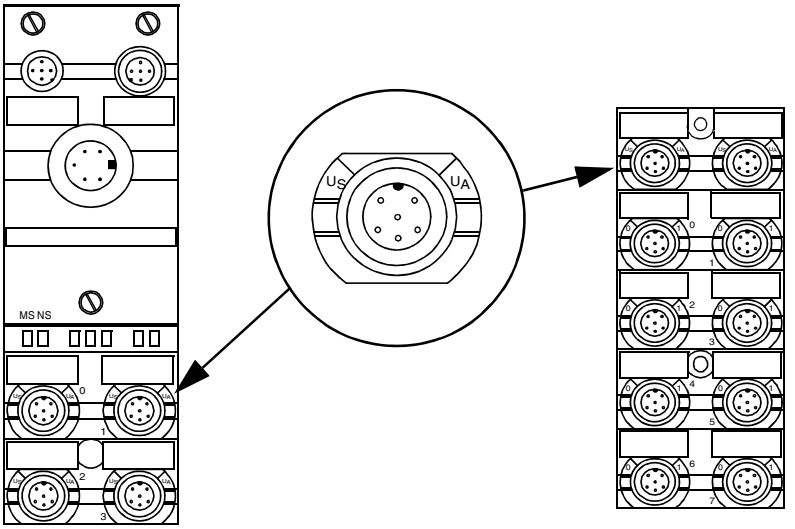
Topic	Page
Power supply diagnostics	94
Field Bus Status Diagnostics LED	96
Internal Bus Diagnostics LEDs	97
Discrete I/O Diagnostics LEDs	98
Analog I/O Diagnostics LEDs	99
Software Diagnostics	100
Behavior in the Event of Short-circuit / Overload / Under-voltage	101

Power supply diagnostics

Description

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

Position of LEDs on the module and splitter boxes:



LED	Meaning
U_A	Actuator power supply diagnostics 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:

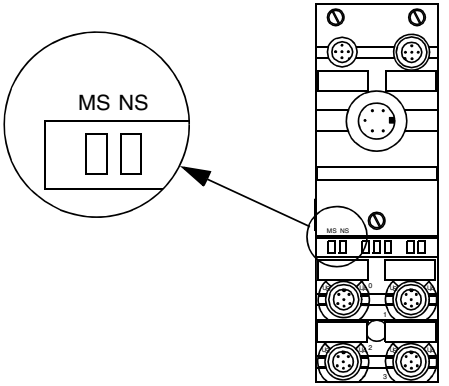
LED description	LED status	Description
U_A	Green	Correct (> 18 VDC)
U_A	Red	Under-voltage or short-circuit on actuator power supply
U_A	Off	No power supply or power supplied to actuators < 12.5 VDC

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

Field Bus Status Diagnostics LED

Display description

Position of the MS and NS LEDs on the front panel:



LED/MS

Display	Status	Meaning
	Off	The self-testing is not finished
	Green	The self-testing is finished

LED/NS

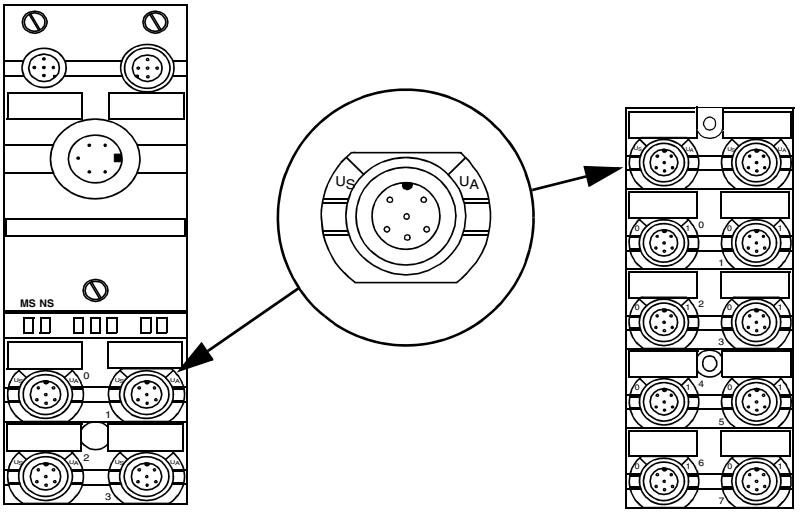
Display	Status	Meaning
	Off	The Dup-Mac test* is not finished. No other bus elements in the DeviceNet network.
	Blinking green	The Dup-Mac test* is not finished. No link with the master.
	Green	Link established with the master (explicit link and/or I/O link).
	Blinking red	No more connection with the (Timeout master, bus link interrupted).
	Red	Bus link interrupt, physical fault on the bus (voltage reset required).

*Dup-Mac test: Duplicate MAC-ID test

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

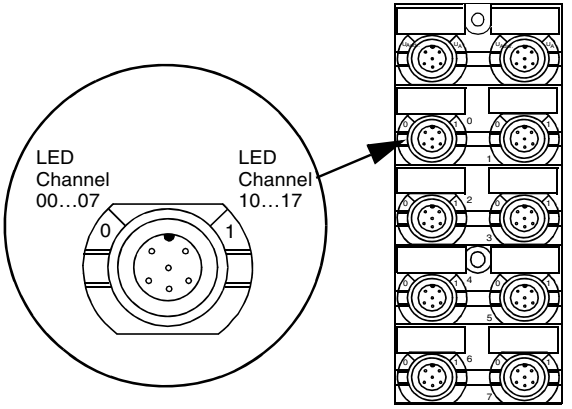
The status of system communication at the module is specified in the following table:

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.

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
-	24VDC 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
-	24VDC 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)	

Software Diagnostics

Description

There are two methods for reading diagnostic data:

- The first method involves using an instance of the "Assembly" object (class 4) that enables implicit I/O exchange with the PLC memory. The reading is therefore directly done in the PLC's image memory.
- The second method involves reading the objects containing the diagnostics by requests (classes 64 and 65).

Using the "Assembly" Object

The Assembly object contains the diagnostic data of the coupling device, followed by attributes B and D of class 65H, that correspond to the different connected splitter boxes.

The structure of the input data is given in the description of the *Class 5H, Instance 64H, p. 115* object.

Reading Objects by Requests

The diagnostic objects concerning the communication interface are as follows (class 64H, instance 1H):

- Attribute5: List of splitter box diagnostics. (1 byte per splitter box)
- Attribute 6: Voltage error on the connectors coming from the internal bus.
- Attribute 8: Short-circuit fault on the connectors leaving from the internal bus.

The diagnostic objects concerning the splitter boxes are as follows (class 65H, attribute 51H and following attributes):

General diagnostics

Signals the type of faults present on the splitter box.

DESINA Diagnostics Bytes

DESINA diagnostics is indicated for channels 10 to 17 (or 0 to 7) where they are configured as diagnostics inputs.

Actuator Stop

Actuator stop reported following short circuit on discrete output-configured channel.

Actuator overload

Actuator overload is reported if discrete output receives > 11 V power supply while set to 0.

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.

Object Dictionary

9

At a Glance

Description

This chapter provides a description of the object dictionary, as well as the list of objects used by DeviceNet.

What's in this Chapter?

This chapter contains the following sections:

Section	Topic	Page
9.1	Structure of Objects	105
9.2	Class 1H, Identity object	108
9.3	Class 2H, Message Router Object	110
9.4	Class 3H, DeviceNet Object	111
9.5	Class 4H, Assembly Object	113
9.6	Class 5H, Connection Object	117
9.7	Class 2BH, Acknowledge handler Object	120
9.8	Class 64H, Coupling Device Configuration	122
9.9	Class 65H, Splitter Boxes	125

9.1 Structure of Objects

Presentation

Description

The I/O splitter box data are assembled in the accessible objects via the FTM 1DN10 coupling device. They are presented in the section that follows.

What's in this Section?

This section contains the following topics:

Topic	Page
General Structure of Objects	106
Class Summary	107

General Structure of Objects

Description

An object is a set of data called "Attributes". The attributes of objects are organized in a structured model called a "Class".

For each object, a class defines the organization of the attributes, their types and the access methods or "Utilities" allowed.

This model can then be instanced in an iterative manner.

For example, if 2 identical I/O splitter boxes are connected to the coupling device , two sets of data organized in the same manner but which contain different values will be implemented. There will be two instances of the same class, each containing a set of attributes with different values.

For certain objects, the instances can contain different attributes. It is the case for the standard objects used for communication or for the configuration object.

Utilities

The following table describes the supported services for accessing data:

Code (Hexadecimal)	Abbreviation	Name	Description
05	Reset	Reset	Default values applied
0E	Get	Get_single_attribut	Reading data
10	Set	Set_single_attribut	Writing data
16	Save	Save	Saving parameters

Class Summary

Description

The classes used by the FTM DeviceNet splitter boxes are listed in the table below:

Class (Hexadecimal)	Name	Contents
1	Identity	Product information
2	Message router	Used for explicit messages
3	DeviceNet	Network communication function characteristics
4	Assembly	Groups the splitter box data for operation by user application (data exchanged in implicit manner)
5	Connection	Defines the data transmission mode
2B	Acknowledge handler	Acknowledgement management
64	Coupling device	Data specific to the coupling device
65	Splitter boxes	Data specific to splitter boxes

9.2 Class 1H, Identity object

Description

At a Glance

The Identity object contains general information on the distributor used.

What's in this Section?

This section contains the following topics:

Topic	Page
Class 1H: Instance 0H	109
Class 1H: Instance 1H	109

Class 1H: Instance 0H

Description

Attribute (Hexadecimal)	Name	Utilities	Type	Description
1	Revision	Get	UINT	Revision of the object definition
2	Max. instance	Get	UINT	Max number of instances

Class 1H: Instance 1H

Description

Attribute (Hexadecimal)	Name	Utilities	Type	Description	Notes
1	Vendor ID	Get	UINT	Manufacturer's identification code	243H
2	Device Type	Get	UINT	Product profile	Communication interface
3	Product Code	Get	UINT	Product code	56502
4	Revision	Get	STRUCT OF	Object revision	
	Major Revision	Get	USINT		02
	Minor Revision	Get	USINT		02
5	Status	Get	UDINT	Communication status	
6	Serial Number	Get	UDINT	Serial number	
7	Product Name	Get	SHORT STRING		FTM1DN10
10	Heartbeat interval	Get / Set	USINT	Period between two messages Heartbeat	In seconds

9.3 Class 2H, Message Router Object

Attributes and Available Services

Description This object has neither attribute nor available service.

9.4 Class 3H, DeviceNet Object

At a Glance

Description

The DeviceNet object contains the device's general communication characteristics.

At power up, the device address is read on the rotary switches and the transmission speed is automatically detected. Data is then saved in the RAM.

What's in this Section?

This section contains the following topics:

Topic	Page
Class 3H: Instance 0H	112
Class 3H: Instance 1H	112

Class 3H: Instance 0H

Description

Attributes	Name	Utilities	Type	Description	Notes
1	Revision	Get	UINT	Revision of the object definition	2

Class 3H: Instance 1H

Description

Attributes	Name	Utilities	Type	Description	Notes
1	MAC ID	Get	USINT	Network address	0...63 63 by default
2	Baud Rate	Get	USINT	Transmission Speed	0 : 125 Kbits/s (by default) 1 : 250 Kbits/s 2 : 500 Kbits/s
3	BOI	Get Set	BOOL	Bus Off Interrup	
4	Bus Off counter	Get Set	USINT	Number of times the CAN controller switches to OFF	0...255
5	Allocation information		STRUCT OF		
	Allocation choice type	Get	BYTE		
	MAster's MAC ID	Get	USINT	Master address	

9.5 Class 4H, Assembly Object

At a Glance

Description

The assembly object assembles in various instances the data useful to the user application for implicit exchanges of:

- Input data
- Output data
- diagnostics data
- settings data

The useful data are contained in attribute 3 of the various instances. Attribute 3 comes as a byte table.

For the bytes that represent the channels: Bit 0 (LSb) represents channel 00 or 10, bit 7 (MSb) represents channel 07 or 17.

What's in this Section?

This section contains the following topics:

Topic	Page
Class 4H: Instance 0H	114
Class 4H: Instance 64H	115
Class 4H: Instance 65H	116

Class 4H: Instance 0H

Description

Attributes	Name	Utilities	Type	Description	Notes
1	Revision	Get	UINT	Revision of the object definition	2

Class 4H: Instance 64H

Description

Attribute	Name	Utilities	Type	Description	Notes
3	Input data	Get	ARRAY OF BYTE	Input data	The structure of the byte table is given below

Structure of the Byte Table

Byte					Description
	Island element	Class	Instance	Attribute	
0	Module	64H	1	6	Voltage diagnostics
1					
2				8	Short-circuit diagnostics
3		No internal return			Status of the communication on the internal bus: 0H: System initialization 1H: Data exchange (normal) 80H: configuration in progress FEH: Security mode
4 ... (4+n)-1	Splitter box 1	65H	1	AH, BH or DH	First splitter box input and/or diagnostics data of the(length = n bytes)
(4+n) ... (4+n+p)-1	Splitter box 2		2		Second splitter box input and/or diagnostics data (length = p bytes)
(4+n+p) ... (4+n+p+q)-1	Splitter box 3		3		Third splitter box input and/or diagnostics data (length = q bytes)
4+n+p+q ...	...				

Class 4H: Instance 65H

Description

Attributes	Name	Utilities	Type	Description	Notes
3	Output data	Get Set	ARRAY OF BYTE	Output data	The structure of the byte table is given below

Structure of the Byte Table

Byte	Data origins				Description
	Island element	Class	Instance	Attributes	
0 ... n-1	Splitter box 1	65H	1	CH	First splitter box output data (length = n bytes)
n ... (n+p)-1	Splitter box 2		2		Second splitter box output data (length = p bytes)
(n+p) ... (n+p+q)-1	Splitter box 3		3		Third splitter box output data (length = q bytes)
n+p+q ...	...				

9.6 Class 5H, Connection Object

At a Glance

Description

An instance is attributed at each link. Their structure is in compliance with the ODVA DN Specification Volume I Release 2.0 Errata 5.

What's in this Section?

This section contains the following topics:

Topic	Page
Class 5: Instance 0H	118
Class 5: Instances 1H to 4H	119

Class 5: Instance 0H

Description

Attributes	Name	Utilities	Type	Description	Notes
1	Revision	Get	UINT	Revision of the object definition	2

Class 5: Instances 1H to 4H

Description

Attribute (Hexadecimal)	Name	Utilities	Type	Description
1	State	Get / Set	USINT	Object status
2	Instance Type	Get / Set	USINT	Connection type: message or I/O
3	Transportclass_trigger	Get / Set	BYTE	
4	Produced_connection_id	Get / Set	UINT	Connection identifier
5	Consumed_connection_id	Get / Set	UINT	Receiving message identifier
6	Initial_comm_characteristics	Get / Set	BYTE	Definition of groups of message reception
7	Produced_connection_size	Get / Set	UINT	Maximum length of transmitted data
8	Consumed_connection_size	Get / Set	UINT	Maximum length of received data
9	Expected_packet_rate	Get / Set	UINT	Definition of timing associated to the connection
C	Watchdog_timeout_action	Get / Set	USINT	Behavior in the Event of a Fault
D	Produced_connection_path_length	Get / Set	UINT	Number of bytes of the attribute E
E	Produced_connection_path	Get / Set	EPATH	Application objects produced by this connection
F	Consumed_connection_path_ length	Get / Set	UINT	Number of bytes of the attribute 10
10	Consumed_connection_path	Get / Set	EPATH	Application objects received by this connection
11	Production_inhibit_time	Get / Set	UINT	Minimum time before sending the next message (except cyclic transmissions).

Note:
- Instance 1: Explicite Message Connection,
- Instance 2: Poll Connection,
- Instance 3: Change of State Connection,
- Instance 4: Cycle Connection.

9.7 Class 2BH, Acknowledge handler Object

At a Glance

Description

The Acknowledge handler object contains the information on acknowledgement management.

What's in this Section?

This section contains the following topics:

Topic	Page
Class 2BH: Instance 0H	121
Class 2BH: Instance 1H	121

Class 2BH: Instance 0H

Description

Attribute	Name	Utilities	Type	Description	Notes
1	Revision	Get	UINT	Revision of the object definition	2

Class 2BH: Instance 1H

Description

Attribute	Name	Utilities	Type	Description
1	Acknowledge timer	Get / Set	UINT	Acknowledgement delay time before retry.1...64636 s 16 by default
2	Retry limit	Get / Set	USINT	Number of acknowledgement timing overshoot before Retry Limit Reached 0...255, 1 by default
3	COS producing Connection instance	Get / Set	UINT	Connection instance identifier for event notification from acknowledgement manager.
4	Ack list size	Get	BYTE	Maximum number of acknowledgments in the list.
5	Ack list	Get	• BYTE • ARRAY OF UINT	Number and list of active connection instances receiving acknowledgements.
6	Data with ack path list size	Get	BYTE	Maximum number of members in the data list with acknowledgement path.

7	Data with ack path list	Get	• BYTE
			• ARRAY OF :
			  • UINT
			  • USINT
			  • ARRAY OF USINT
				Number of members and list of instance identifiers for the:
				• connection
				• path length
				• DeviceNet path

9.8 Class 64H, Coupling Device Configuration

Presentation

Description

This section contains data specific to the coupling device.

What's in this Section?

This section contains the following topics:

Topic	Page
Class 64H: Instance 0H	123
Class 64H: Instance 1H	123

Class 64H: Instance 0H

Description

Attribute	Name	Utilities	Type	Description	Notes
1	Revision	Get	UINT	Revision of the object definition	2

Class 64H: Instance 1H

Description

Attributes	Name	Utilities	Type	Description	Notes
3H	Number of discrete splitter boxes	Get	BYTE	Number of splitter boxes connected	
4H	Total number of I/O channels	Get	UINT	Total number of I/O channels on the connected splitter boxes	
5H	General diagnostics	Get	ARRAY OF WORD	List of general splitter box diagnostics	This word table includes the general diagnostics of the connected splitter boxes. (see class 65H)
6H	Coupling device diagnostics	Get	WORD	Coupling device voltage error reports	See structure below
7H	List of splitter boxes	Get	ARRAY OF WORD	Reference list for the connected splitter boxes	The first reference is that of the coupling device
8H	Power supply short-circuit	Get	BYTE	Coupling device short-circuit reports	See structure below
AH	Manufacturer Hardware Version	Get	BYTE	Hardware version number	Example: "100" for version 1.00
BH	Manufacturer Software Version	Get	BYTE	Software version number	Example: "205" for version 2.05
14H	Save	Get / Set	BYTE	Save current parameters command	See *Saving and Restoring Parameters, p. 72*
15H	Restore	Set	WORD	Restore factory settings command	See *Saving and Restoring Parameters, p. 72*

Attribute 6H

This word indicates that there is no voltage or an under-voltage in each of the connectors leaving from the internal bus:

Bit	Fault	Controller	Voltage type
0	Under-voltage	Connector 0	Detector (U_S)
1			Actuator (U_A)
2		Connector 1	Detector (U_S)
3			Actuator (U_A)
4		Connector 2	Detector (U_S)
5			Actuator (U_A)
6		Connector 3	Detector (U_S)
7			Actuator (U_A)
8	No voltage	Connector 0	Detector (U_S)
9			Actuator (U_A)
10		Connector 1	Detector (U_S)
11			Actuator (U_A)
12		Connector 2	Detector (U_S)
13			Actuator (U_A)
14		Connector 3	Detector (U_S)
15			Actuator (U_A)

Attribute 8H

This byte indicates the short-circuit faults in each of the connectors leaving from the internal bus:

Bit	Fault	Controller	Voltage type
0	Short circuit	Connector 0	Detector (U_S)
1			Actuator (U_A)
2		Connector 1	Detector (U_S)
3			Actuator (U_A)
4		Connector 2	Detector (U_S)
5			Actuator (U_A)
6		Connector 3	Detector (U_S)
7			Actuator (U_A)

9.9 Class 65H, Splitter Boxes

Presentation

Description

This section contains data specific to the splitter boxes.

What's in this Section?

This section contains the following topics:

Topic	Page
Class 65H: Instance 0H	126
Class 65H: Instance 1H and the Following Instances	126
Class 65H: 1H and Following Instances, Attributes 3H to 27H	127
Class 65H: 1H and Following Instances, Attributes 28H to 4F of Discrete Splitter Boxes	130
Class 65H: 1H and Following Instances, Attributes 28H to 33H for Analog Splitter Boxes	131
Class 65H: 1H and Following Instances, Attributes 50H to 64H	134

Class 65H: Instance 0H

Description

Attributes	Name	Utilities	Type	Description	Notes
1	Revision	Get	UINT	Revision of the object definition	1

Class 65H: Instance 1H and the Following Instances

Description The number of instances is governed by the number of splitter boxes. The structure of each instance is as follows:

Attributes	Name	Utilities	Type	Description
3H	Status	Get	BYTE	Status of the communication on the internal bus
4H	Name	Get	STRING	Name of the Coupling Device
5H	ID	Get	WORD	Identification number
6H	Type	Get	WORD	Device type
7H	Manufacturer ID	Get	WORD	Manufacturer identifier
8H	Number of connectors	Get	WORD	Number and type of female connectors
9H	HW/SW revision	Get	DWORD	• MSB : Software revision number • LSB : Hardware revision number
AH	Input data	Get	ARRAY OF BYTE	Splitter box input bytes
BH	Input and diagnostic data	Get	ARRAY OF BYTE	Splitter box input and diagnostic bytes
CH	Output data	Get / Set	ARRAY OF BYTE	Splitter box output bytes
DH	Diagnostic data	Get	ARRAY OF BYTE	Splitter box diagnostic bytes
14H ... 1DH	Input words	Get	WORD	Input words
1EH ... 27H	Output words	Get / Set	WORD	Output words
28H ... 4FH	Configuration words	Get / Set	WORD	Configuration words
50H ... 64H	Device diagnostics	Get	WORD	Device diagnostics

Class 65H: 1H and Following Instances, Attributes 3H to 27H

Attribute 3H

This word indicates that there is no voltage or an under-voltage in each of the connectors leaving from the internal bus:

Value	Meaning	Notes
1H	Data exchange	Normal operating mode: Communication is established between the splitter box and the coupling device.
80H	Initialization	Communication initialized at start-up or communication error on the internal bus.

Attribute 4H at 8H

Attribute 4H presents the splitter box reference as a string of characters and attribute 5H, its identifier.

Attribute 6H gives information on the type of channels available on the splitter box:

- 1 : Discrete inputs
- 3 : Discrete inputs and outputs
- 4 : Analog inputs
- 8 : Analog outputs

Attribute 7H contains the manufacturer's identifier (=1).

Attribute 8H contains the number of connectors available for the I/O-channel connection.

Reference (Attribute 4H)	ID (Attribute 5H)	Type (Attribute 6H)	Number of connectors (Attribute 8H)
FTM 1DD16C12	56600	3	8* M12
FTM 1DD16C12E	56601	3	8* M12
FTM 1DE16C12	56602	1	8* M12
FTM 1DE16C12E	56603	1	8* M12
FTM 1DD08C12	56610	3	4* M12
FTM 1DD08C12E	56611	3	4* M12
FTM 1DE08C12	56612	1	4* M12
FTM 1DE08C12E	56613	1	4* M12
FTM 1DD08C08	56620	3	8* M8
FTM 1DD08C08E	56621	3	8* M8
FTM 1DE08C08	56622	1	8* M8
FTM 1DE08C08E	56623	1	8* M8
FTM 1AE04C12T	56700	4	4* M12
FTM 1AS04C12T	56710	8	4* M12
FTM 1AS04C12C	56720	8	4* M12
FTM 1AE04C12C	56730	4	4* M12

Attributes AH to DH

These attributes contain different forms of splitter box data. They are used by the "Assembly" object:

Reference	Input data	Diagnostics data	Output data
FTM 1DN10	-	4	-
FTM 1DD16C12	2	8	2
FTM 1DD16C12E	2	8	2
FTM 1DE16C12	2	4	-
FTM 1DE16C12E	2	4	-
FTM 1DD08C12	2	8	2
FTM 1DD08C12E	2	8	2
FTM 1DE08C12	2	4	-
FTM 1DE08C12E	2	4	-
FTM 1DD08C08	1	5	1
FTM 1DD08C08E	1	5	1
FTM 1DE08C08	1	3	-
FTM 1DE08C08E	1	3	-
FTM 1AE04C12T	8	5	-
FTM 1AS04C12T	-	5	8
FTM 1AS04C12C	-	5	8
FTM 1AE04C12C	8	5	-

Discrete splitter box input data:

- Byte 0: Channels 00 to 07
- Byte 1: Channels 10 to 17

Discrete splitter box output data

- Byte 0: Channels 00 to 07
- Byte 1: Channels 10 to 17

Analog splitter box input data:

- Bytes 0 & 1: Channel 0
- Bytes 2 & 3: Channel 1
- Bytes 4 & 5: Channel 2
- Bytes 6 & 7: Channel 3

Analog splitter box output data:

- Bytes 0 & 1: Channel 0
- Bytes 2 & 3: Channel 1
- Bytes 4 & 5: Channel 2
- Bytes 6 & 7: Channel 3

Diagnostic data: See the diagnostics chapter.

Attribute 14H at 1DH

These attributes are used to read the input statuses:

Attributes	Discrete splitter box	Analog splitter box
14H	• Byte 0: Channels 00 to 07 • Byte 1: Channels 10 to 17	Channel 0
15H	Reserved	Channel 1
16H	Reserved	Channel 2
17H	Reserved	Channel 3
18H	Reserved	

Attribute 1EH at 27H

These attributes are used to read the output statuses:

Attributes	Discrete splitter box	Analog splitter box
1EH	• Byte 0: Channels 00 to 07 • Byte 1: Channels 10 to 17	Channel 0
1FH	Reserved	Channel 1
20H	Reserved	Channel 2
21H	Reserved	Channel 3
22H...27H	Reserved	

Class 65H: 1H and Following Instances, Attributes 28H to 4F of Discrete Splitter Boxes

Description

These attributes are used to configure the discrete splitter boxes.

Discrete Splitter Boxes with M12 connector

Attributes 28H to 2CH are used as indicated in the table below to, with the following rule:

- LSB : Channels 00 to 07
- MSB : Channels 10 to 17

Attributes	Function	Value	Notes
28H	Input / Diagnostics	• 0 : Input • 1 : Diagnostic (by default)	Only for channels 10 to 17
29H	Input / Output	• 0 : Input (by default) • 1 : Output	FTM 1DD•• only
2AH	Fallback mode	• 0 : Fallback (by default) • 1 : Last value maintained	
2BH	Fallback value	• 0 : Output at 0 (by default) • 1 : Output at 1	
2CH	Polarity	• 0 : NO (default) • 1 : NC	

Discrete Splitter Boxes with M8 connector

Attributes 28H to 2CH are used as indicated in the table below to, with the following rule:

- LSB : Channels 00 to 07
- MSB : Channels 10 to 17

Attributes	Byte	Function	Value	Notes
40H	0	Fallback mode	• 0 : Fallback (by default) • 1 : Last value maintained	FTM 1DD•• only
	1	Input/ Output.	• 0 : Input (by default) • 1 : Output	
41H	0	Polarity	• 0 : NO (default) • 1 : NC	
	1	Fallback value	• 0 : Output at 0 (by default) • 1 : Output at 1	

Class 65H: 1H and Following Instances, Attributes 28H to 33H for Analog Splitter Boxes

Description of Analog Input Splitter Boxes

Attributes 28H to 2CH are used as indicated in the table below:

Attributes	Function	Description
28H	Channel 1 settings	See below
29H	Channel 2 settings	
2AH	Channel 3 settings	
2BH	Channel 4 settings	
2CH	Additional settings for channel 1	**Diagnostics bit [0]** • 0: 0 activated (by default) • 1: Disabled **Data format bit [1]** • 0 : Motorola format (Most significant - Least significant) • 1 : Intel format (Least significant - Most significant) **Delta bit [2]** • 0 : Deactivated (by default) • 1 : Enabled **Other bits** Reserved
2DH	Additional settings for channel 2	
2EH	Additional settings for channel 3	
2FH	Additional settings for channel 4	
30H	Delta channel 1	The delta value must be between 0 and 32 767.
31H	Delta channel 2	
32H	Delta channel 3	
33H	Delta channel 4	

Note: In order to validate use of the Delta, bit 2 of the corresponding additional configuration word must be at 1.

Setting Analog Input Splitter Box Channels

Attributes 28H to 2BH are used as indicated in the table below:

Attribute value	Scale for FTM 1AE04C12T	Scale for FTM 1AE04C12C	Filtering
0 or > 8	Channel deactivated		-
1	+/- 10V	0...20 mA	None
2	0...10 V	4...20 mA	
3	+/- 10V	0...20 mA	Low
4	0...10 V	4...20 mA	
5	+/- 10V	0...20 mA	Medium
6	0...10 V	4...20 mA	
7	+/- 10V	0...20 mA	High
8	0...10 V	4...20 mA	

Description of Analog Output Splitter Boxes

Attributes 28H to 2CH are used as indicated in the table below:

Attributes	Function	Description
28H	Channel 1 settings	See below
29H	Channel 2 settings	
2AH	Channel 3 settings	
2BH	Channel 4 settings	
2CH	Additional settings for channel 1	**Diagnostics bit [0]** • 0: 0 activated (by default) • 1: Disabled **Data format bit [1]** • 0: Motorola format (Most significant - Least significant) • 1: Intel format (Least significant - Most significant) **Fallback mode bit [2]** • 0: Last value maintained • 1: Fallback **Other bits** Reserved
2DH	Additional settings for channel 2	
2EH	Additional settings for channel 3	
2FH	Additional settings for channel 4	
30H	Fallback value	The fallback mode value depends on the scale used. It must be between: • -2048 and 2047 for the +/-10 V scale • 0 and 2047 for the other scales
31H	Fallback value	
32H	Fallback value	
33H	Fallback value	

Setting Analog Output Splitter Box Channels

Attributes 28H to 2BH are used as indicated in the table below:

Attribute value	Scale for FTM 1AS04C12T	Scale for FTM 1AS04C12C
0 or > 2	Channel deactivated	
1	+/- 10V	0...20 mA
2	0...10 V	4...20 mA

Class 65H: 1H and Following Instances, Attributes 50H to 64H

Description These attributes are used to read the diagnostics data.

FTM 1DE16C12•

Attributes	Diagnostics	Notes
50	Global diagnostics	Number of splitter box diagnostics and communication status
51	General diagnostics	• Bit 0: Detector power supply under-voltage • Bit 1: Not assigned • Bit 2: Not assigned • Bit 3: Detector power supply short-circuit • Bits 4...7: Not assigned
	Detector power supply short circuit	Bits 8...15: Connectors 0...7
52	Wire cut detection	Bits 0...7: Channels 10...17

FTM 1DD16C12•

Attributes	Diagnostics	Notes
50	Global diagnostics	Number of splitter box diagnostics and communication status
51	General diagnostics	• Bit 0: Detector power supply under-voltage • Bit 1: Actuator power supply under-voltage • Bit 2: External power supply under-voltage (FTM 1DD16C12) • Bit 3: Power supply short-circuit in detectors • Bit 4: Actuator stopped, channels 00...07 • Bit 5: Actuator stopped, channels 10...17 • Bit 6: Actuator overload, channels 00...07 • Bit 7: Actuator overload, channels 10...17
	Detector power supply short-circuit	Bits 8...15: Connectors 0...7
52	Actuator stopped	Bits 0...15: Channels 00...17
53	Actuator overload	Bits 0...15: Channels 00...17
54	Wire cut detection	Bits 0...7: Channels 10...17

FTM 1DE08C12•

Attributes	Diagnostics	Notes
50	Global diagnostics	Number of splitter box diagnostics and communication status
51	General diagnostics	• Bit 0: Detector power supply under-voltage • Bit 1: Not assigned • Bit 2: Not assigned • Bit 3: Detector power supply short-circuit • Bits 4...7: Not assigned
	Detector power supply short-circuit	• Bits 8...11: Connectors 0...3 • Bits 12...15: Not assigned
52	Wire cut detection	Bits 0...3: Channels 10...13

FTM 1DD08C12•

Attributes	Diagnostics	Notes
50	Global diagnostics	Number of splitter box diagnostics and communication status
51	General diagnostics	• Bit 0: Detector power supply under-voltage • Bit 1: Power supply under-voltage in actuator • Bit 2: Not assigned • Bit 3: Power supply short-circuit in detectors • Bit 4: Actuator stopped, channels 00...03 • Bit 5: Actuator stopped, channels 10...13 • Bit 6: Actuator overload, channels 00...03 • Bit 7: Actuator overload, channels 10...13
	Detector power supply short-circuit	• Bits 8...11: Connectors 0...3 • Bits 12...15: Not assigned
52	Actuator stopped	Bits 0...15: Channels 00...13
53	Actuator overload	Bits 0...15: Channels 00...13
54	Wire cut detection	Bits 0...3: Channels 10...13

FTM 1DE08C08•

Attributes	Diagnostics	Notes
50	Global diagnostics	Number of splitter box diagnostics and communication status
51	General diagnostics	• Bit 0: Detector power supply under-voltage • Bits 1 and 2 Not assigned • Bit 3: Power supply short-circuit in detectors • Bits 4...7: Not assigned
	Detector power supply short-circuit	Bits 8...15: Connectors 0...7

FTM 1DD08C08•

Attributes	Diagnostics	Notes
50	Global diagnostics	Number of splitter box diagnostics and communication status
51	General diagnostics	• Bit 0: Detector power supply under-voltage • Bit 1: Power supply under-voltage in actuator • Bit 2: Not assigned • Bit 3: Power supply short-circuit in detectors • Bit 4: Actuator stopped, channels 00...07 • Bit 5: Not assigned • Bit 6: Actuator overload, channels 00...07 • Bit 7: Not assigned
	Detector power supply short-circuit	Bits 8...15: Connectors 0...7
52	Actuator stopped	Bits 0...7: Channels 00...07
	Actuator overload	Bits 8...15: Channels 00...07

FTM 1AE04C12T

Attributes	Diagnostics	Notes
50	General diagnostics	• Bit 0: Detector power supply under-voltage • Bit 3: 24 V detector power supply short-circuit (pin 1) • Bit 6: Scale overshoot (less, +/- 10 V only) • Bit 7: Scale overshoot (greater)
51	Channel 0 (LSB)	• Bits 2 and 10 Scale overshoot (greater) • Bits 3 and 11 Scale overshoot (less, +/- 10 V only) • Bits 4 and 12 24 V detector power supply short-circuit (pin 1)
	Channel 1 (MSB)	
52	Channel 2 (LSB)	
	Channel 3 (MSB)	

FTM1AE04C12C

Attributes	Diagnostics	Notes
50	General diagnostics	• Bit 0: Detector power supply under-voltage • Bit 3: 24 V detector power supply short-circuit (pin 1) • Bit 5: Cable breakage • Bit 6: Scale overshoot (less, +/- 10 V only) • Bit 7: Scale overshoot (greater)
51	Channel 0 (LSB)	• Bits 0 and 8 Cable breakage • Bits 2 and 10 Scale overshoot (greater) • Bits 3 and 11 Scale overshoot (less, +/- 10 V only) • Bits 4 and 12 24 V detector power supply short-circuit (pin 1)
	Channel 1 (MSB)	
52	Channel 2 (LSB)	
	Channel 3 (MSB)	

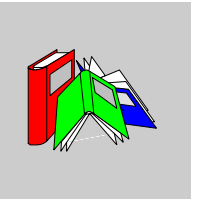
FTM1AS04C12T

Attributes	Diagnostics	Notes
50	General diagnostics	• Bit 0: Detector power supply under-voltage • Bit 1: Actuator power supply under-voltage • Bit 2: Power cut in actuators • Bit 3: 24 V detector power supply short-circuit (pin 1) • Bit 4: Setpoint value deactivated
51	Channel 0 (LSB)	• Bits 1 and 9 Setpoint value deactivated • Bits 4 and 12 24 V detector power supply short-circuit (pin 1)
	Channel 1 (MSB)	
52	Channel 2 (LSB)	
	Channel 3 (MSB)	

FTM 1AS04C12C

Attributes	Diagnostics	Notes
50	General diagnostics	• Bit 0: Detector power supply under-voltage • Bit 1: Actuator power supply under-voltage • Bit 2: Power cut in actuators • Bit 3: 24 V detector power supply short-circuit (pin 1) • Bit 5: Cable breakage
51	Channel 0 (LSB)	• Bits 0 and 8 Cable breakage • Bits 4 and 12 24 V detector power supply short-circuit (pin 1)
	Channel 1 (MSB)	
52	Channel 2 (LSB)	
	Channel 3 (MSB)	

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.

C

Configuration — 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.

D

DESINA — Standard relating to the connector technology of sensors and actuators, established by a German association of machine manufacturers.

DeviceNet, protocol DeviceNet is a network based on low level connections and established over CAN, using a serial bus system without a defined application layer. Consequently, DeviceNet defines a layer for the industrial application of the CAN protocol.

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.

Dup Mac *Duplicate MAC ID*. Network startup test used to check if any DeviceNet equipment is using the same MAC ID address.

E

EDS *Electronic Data Sheet*. The EDS is a file in standard ASCII format containing information on a communication functionality of a network device and the content of its object dictionary. The EDS also defines device-specific and manufacturer-specific objects.

Electro-magnetic interference Electro-magnetic interferences (EMI) are liable to cause interruptions, anomalies or disturbances in the performance of electronic hardware. It occurs 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 secure mode to which any 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

I/O module In a programmable control system, an I/O module communicates directly with sensors or actuators used in the machine or process. This module is the component that is installed in the I/O connection base and establishes the electrical connections between the controller and the fieldbuses. The functionalities common to all I/O modules are offered in a range of signal capacities and levels.

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.

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.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.

Object Dictionary Sometimes referred to as the "object directory", this element of the DeviceNet device model provides the plan for the internal structure of DeviceNet devices. 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 DeviceNet fieldbus, you can anticipate its network behavior enabling you to design a distributed application in which it can be implemented.

Output polarity	The polarity of an output channel determines when the output module activates its fieldbus actuator and when it deactivates it. 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.
PE	*Protective Earth* in English, Ground.
Peer	*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.
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.
Sink load (or positive logic load)	Designates an output which, when activated, receives DC current from its load.
Telegram	A data packet used in serial communications.

Index

C

Characteristics
- Inputs, 46
- of its Environment, 38
- Outputs, 49
- Splitter box, 49

D

Diagnostics
- Analog I/O, 99
- Discrete I/O, 98
- Internal bus, 97
- Power supply, 94

E

EMC Compatibility, 31

F

Field Bus Status Diagnostics, 96

G

Ground Electrode
- Connection, 29
- Position, 29

I

Internal Bus
- Connection, 43
- Terminator, 44
- Wiring Diagram, 43

M

M12 Connector
- Pin Assignment for Actuators and Sensors, 47, 50

M12 Connectors
- Field Bus Pin Assignment, 55

M8 Connector
- Assignment of pins for actuators and sensors, 48

Master, 142

N

N, 142

Node-ID
- Configuration, 59

O

Object, 143

P

PE, 143

Properties, 38
    Input, 49
    outputs, 46
    Splitter box, 46

R

Reverse, 143

S

Sink, 143

T

Telegram, 143
Transmission Speed
    Configuration, 59