Modicon
Terminal Block I/O Modules
Hardware Reference Guide

890 USE 104 00 Version 2.0

February 1996

AEG Schneider Automation, Inc.
One High Street
North Andover, MA 01845

Preface

This book describes Modicon Terminal Block Input/Output (TIO) modules. It provides specifications for the modules, and describes how to install them and connect them to field devices in the user application.

The book also presents guidelines for connection of the modules to a Modbus Plus or InterBus-S network. Further details about development of network applications may be found in the reference publications listed in this book.

The data and illustrations found in this book are not binding. We reserve the right to modify our products in line with our policy of continuous product development. The information in this document is subject to change without notice and should not be construed as a commitment by AEG Schneider Automation, Inc.

AEG Schneider Automation assumes no responsibility for any errors that may appear in this document. If you have any suggestions for improvements or amendments or have found errors in this publication, please notify us by using the form on the last page of this publication.

No part of this document may be reproduced in any form or by any means, electronic or mechanical, including photocopying, without express written permission of the Publisher, AEG Schneider Automation, Inc.

Caution: All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to assure compliance with documented system data, repairs to components should be performed only by the manufacturer.

MODSOFT® is a registered trademark of AEG Schneider Automation, Inc.

The following are trademarks of AEG Schneider Automation, Inc.:

Modbus	Modbus Plus	Quantum Automation Series
Modicon	984	

© Copyright 1996, AEG Schneider Automation, Inc.
Printed in U.S.A.

Contents

Chapter 1
Modicon Terminal Block I/O Modules 1

1.1 Modicon Terminal Block I/O Modules 2
1.1.1 Planning Your TIO System 2
1.2 Reference Publications 3
1.2.1 Publications for TIO on Modbus Plus 3
1.2.2 Publications for TIO on InterBus-S 3
1.3 Modbus Plus Network Layouts 4
1.4 TIO Modules for Modbus Plus 5
1.5 InterBus-S Network Layouts 6
1.6 TIO Modules for InterBus-S 7
1.7 Environmental Specifications 8

Chapter 2
Installing TIO Modules 9

2.1 Setting the Modbus Plus Node Address 10
2.1.1 Applicable Modules 10
2.1.2 Setting the Modbus Plus Node Address 10
2.1.3 Network Design Options 11
2.1.4 Deterministic I/O Servicing 11
2.1.5 Multi-Function Servicing 11
2.2 Mounting on a DIN Rail or Panel 12
2.3 Selecting Connectors and Bus Bars 13
2.3.1 Availability of Connectors and Bus Bars 13
2.3.2 Spring Terminals 13
2.3.3 Screw Terminals 13
2.4 Inserting Coding Keys Into Connectors 14
2.5 Connecting to the Modbus Plus Network 15
2.6 Connecting to the InterBus-S Remote Bus 16

Breite: 185 mm

170 BDI 342 00
Modbus Plus TIO
24 VDC 16 Input Module 19

Field Wiring Connections 20
LED Indicators 21
Specifications 22

170 BDO 342 00
Modbus Plus TIO
24 VDC 16 Output Module 23

Field Wiring Connections 24
LED Indicators 25
Specifications 26

170 BDM 342 00
Modbus Plus TIO
24 VDC 16 Input / 16 Output Module 27

Field Wiring Connections 28
LED Indicators 29
Specifications 30

170 BDI 542 50
Modbus Plus TIO
115 VAC 16 Input Module 33

Field Wiring Connections 34
LED Indicators 35
Specifications 36

170 BDO 542 50
Modbus Plus TIO
24 ... 230 VAC 16 Output Module 37

Field Wiring Connections 38
LED Indicators 39
Specifications 40

170 BAM 096 00
InterBus–S TIO
Analog Input/Output Module 41

Field Wiring Connections 42
Register Allocation 48
LED Indicators 50
Specifications 51
Input Ranges and Values 52
Output Ranges and Values 53

170 BDI 346 00
Interbus–S TIO
24 VDC 16 Input Module 55

Field Wiring Connections 56
LED Indicators 57
Specifications 58

170 BDO 346 00
InterBus–S TIO
24 VDC 16 Output Module 59

Field Wiring Connections 60
LED Indicators 61
Specifications 62

170 BDM 346 00
InterBus–S TIO
24 VDC 16 Input / 16 Output Module 63

Field Wiring Connections 64
LED Indicators 65
Specifications 66

Breite: 185 mm

170 BDM 346 30
InterBus–S TIO
24 VDC 8 Input / 24 ... 230 VAC/DC 8 Relay Output Module 69

Field Wiring Connections 70
LED Indicators 71
Specifications 72

170 BDI 356 00
Interbus–S TIO
24 VDC 32 Input Module 75

Field Wiring Connections 76
LED Indicators 77
Specifications 78

170 BDO 356 00
InterBus–S TIO
24 VDC 32 Output Module 79

Field Wiring Connections 80
LED Indicators 81
Specifications 82

170 BDI 546 50
InterBus–S TIO
115 VAC 16 Input Module 83

Field Wiring Connections 84
LED Indicators 85
Specifications 86

170 BDI 746 50
InterBus–S TIO
230 VAC 16 Input Module 87

Field Wiring Connections 88
LED Indicators 89
Specifications 90

170 BDO 946 50
InterBus–S TIO
115 ... 230 VAC 16 Output Module 91

Field Wiring Connections 92
LED Indicators 93
Specifications 94

Appendix A
Modbus Plus TIO Registers 95

A .1 Modbus Plus TIO Module Registers 96
A .1.1 Data Registers 97
A .1.2 Configuration Register 98
A .1.3 Status Registers 99
A .2 Write Privilege to Modules 100

Appendix B
CE Compliance 101

B .1 Requirements for CE Compliance 102
B .1.1 CE-Compliant Wiring Examples 102
B .2 Available Components for CE Compliance 103
B .2.1 Capacitive Discharge Terminal and DIN Grounding Clip . 103
B .2.2 AC Line Filters 103
B .3 170 BDI 542 50: Modbus Plus 115 VAC Input Module 104
B .4 170 BDO 542 50: Modbus Plus 24 ... 230 VAC Output Module 105

Breite: 185 mm

Chapter 1
Modicon Terminal Block I/O Modules

- ☐ Modicon Terminal Block I/O Modules
- ☐ Reference Publications
- ☐ Modbus Plus Network Layouts
- ☐ TIO Modules for Modbus Plus
- ☐ InterBus-S Network Layouts
- ☐ TIO Modules for InterBus-S
- ☐ Environmental Specifications

1.1 Modicon Terminal Block I/O Modules

Modicon Terminal Block Input/Output modules provide a cost-effective method for distributed control of field devices in industrial automation applications. Modules are available for controlling and monitoring a wide variety of discrete and analog input/output devices.

Terminal Block Input/Output (TIO) modules can be installed at or near field devices at remote locations in the industrial process. TIO modules are compact, occupying a minimum of mounting space at the device site.

Each TIO module connects to its field devices through local field wiring. Each module connects directly to the industrial communication network, exchanging data and status messages with the programmable controller or other controlling node in the industrial application.

1.1.1 Planning Your TIO System

Modicon TIO modules are available for these types of networks:

□ Modicon Modbus Plus

□ InterBus-S Remote Bus.

Modicon provides programmable controllers and other products that communicate with TIO modules over these networks. Modicon also provides software for the configuration and setup of the TIO modules. In addition, due to the wide acceptance of these networks in industrial applications, many third-party products are available for your use.

Contact your local Modicon product representative for information about available Modicon products for network applications.

1.2 Reference Publications

1.2.1 Publications for TIO on Modbus Plus

Several Modicon publications are available to assist your planning for TIO module applications based on the Modbus Plus network:

Modbus Plus Network Planning and Installation Guide (890 USE 100)
This publication describes how to plan a Modbus Plus network application consisting of programmable controllers, host-based devices, and I/O devices. It presents guidelines for estimating the speed of message transactions in network applications. It includes worksheets for planning the network layout, and for specifying and ordering network components. The publication also defines the requirements for the installation of the network cable, taps, and other media.

Modbus Plus I/O System Planning Guide (840 USE 104)
This publication describes how to incorporate Modicon Distributed I/O (DIO) and Terminal Block I/O (TIO) products into Modbus Plus networks. It presents guidelines for the design of I/O networks that require deterministic timing of I/O processes, and for I/O networks that must include programmers, Man-Machine Interfaces, and other devices.

1.2.2 Publications for TIO on InterBus-S

Publications are available for planning InterBus-S network applications. Contact your local Modicon product representative for information about obtaining additional publications for your planning.

InterBus-S Protocol Structure (Data Sheet 0005C)
This publication describes the InterBus-S protocol format, network control, data movement, and overall implementation. Available from: Phoenix Contact, Inc., P.O. Box 4100, Harrisburg, PA 17111 USA.

1.3 Modbus Plus Network Layouts

The Modicon *Modbus Plus Planning and Installation Guide* provides details for the design and installation of Modbus Plus cable systems.

Modbus Plus nodes connect to taps along a trunk cable, as in Figure 1. Trunk cables consist of simple twisted-pair and shield wire connections.

A single segment of trunk cable supports up to 32 nodes along a cable path of up to 1500 ft (450 m). Up to three Modicon RR85 Repeaters can be used to expand the network to its maximum capacity of 64 nodes and 6000 ft (1800 m). Modicon FR85 Repeaters are also available for further expansion of the network through fibre optic links.

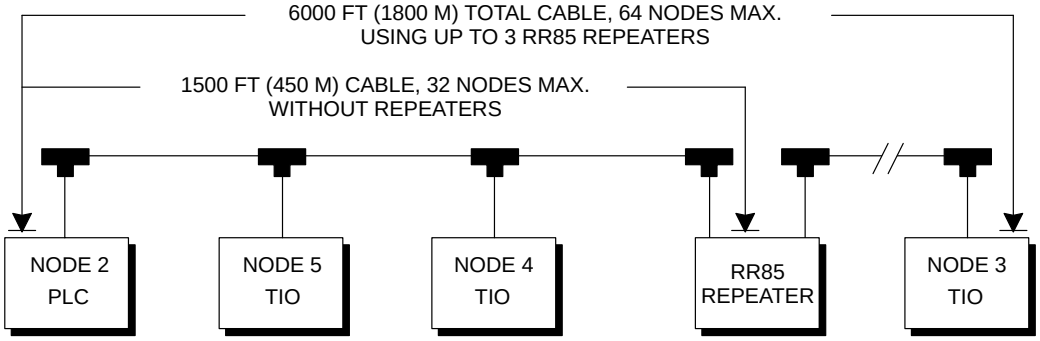


Figure 1 Modbus Plus Network Example

The user assigns a logical address to each node device by setting switches on the device. Addresses are assigned as required by the application and are not related to the physical locations of the nodes. Nodes function as peer-to-peer members of a logical ring, accessing the network by acquiring a token frame that is passed in a rotating address sequence. In Figure 1, a programmable controller is present at node address 2, with TIO modules at addresses 3 ... 5.

Networks can be designed as either a single-cable or dual-cable layout. Dual-cable layouts offer increased protection against cable faults or excessive noise bursts on either cable path, by continuing to process error-free messages on the alternate path.

Repeaters can also be applied in plant environments that have high levels of electrical interference. Repeaters at key points in the system can help to maintain an excellent signal-to-noise ratio on the network.

1.4 TIO Modules for Modbus Plus

The table below summarizes the characteristics of Modicon TIO modules for Modbus Plus network applications. Modules are compliant with the IEC 1131 specification. Complete specifications are provided in the section for each module.

Part Number	Module Type	Inputs	Outputs	Operating Power
170 BDI 342 00	Discrete 16 in	15 ... 30 V dc	– –	20 ... 30 V dc
170 BDO 342 00	Discrete 16 out	– –	20 ... 30 V dc	20 ... 30 V dc
170 BDM 342 00	Discrete 16 in/16 out	15 ... 30 V dc	20 ... 30 V dc	20 ... 30 V dc
170 BDI 542 50	Discrete 16 in	74 ... 132 V ac	– –	85 ... 264.5 V ac
170 BDO 542 50	Discrete 16 out	– –	20.4 ... 253 V ac	85 ... 264.5 V ac

Network Specifications

General specifications of Modbus Plus networks are presented in the Modicon *Modbus Plus Planning and Installation Guide*.

1.5 InterBus-S Network Layouts

Publications for the design and installation of InterBus-S cable systems are available from a variety of sources. Contact your Modicon product representative for information about obtaining InterBus-S publications. Here is an overview to assist your preliminary planning.

InterBus-S nodes connect to a remote bus cable, as shown in Figure 2. Nodes connect to the bus along a total cable path of up to 8 mi (13 km), with a maximum of 1300 ft (400 m) cable length between any pair of nodes. The network supports up to 256 nodes.

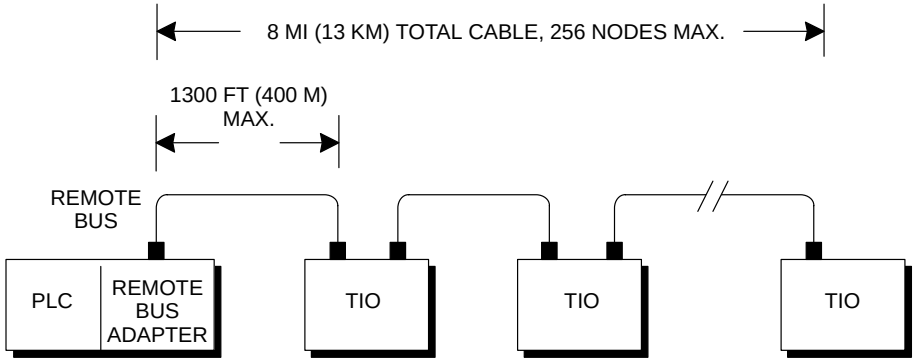


Figure 2 InterBus-S Network Example

Each type of node device is given an imbedded identifier code by the manufacturer to identify the device type to the application software. Nodes are not assigned node addresses by the user. Instead, the network functions as a logical shift register, in which the application's entire data stream originates at a master node and is transferred serially from node to node. In Figure 2, the programmable controller and its associated remote bus adapter function as the master device.

Each node regenerates the entire stream before passing it on to the next node. As each node handles the stream, it extracts the portion that is assigned to that node as input data (into the node), and adds output data (from the node) to the stream as applicable to that type of node device.

Networks can be designed using only the remote bus structure shown in Figure 2, or can employ bus adapters to extend the network to modules on a local bus. Modicon TIO modules are designed for connection only to the remote bus as shown in Figure 2.

1.6 TIO Modules for InterBus-S

The table below summarizes the characteristics of Modicon TIO modules for InterBus S remote bus network applications. Modules are compliant with the IEC 1131 specification. Complete specifications are provided in the section for each module.

Part Number	Module Type	Inputs	Outputs	Operating Power
170 BDI 346 00	Discrete 16 in	15 ... 30 V dc	– –	20 ... 30 V dc
170 BDO 346 00	Discrete 16 out	– –	20 ... 30 V dc	20 ... 30 V dc
170 BDM 346 00	Discrete 16 in/16 out	15 ... 30 V dc	20 ... 30 V dc	20 ... 30 V dc
170 BDM 346 30	Discrete 8 in/8 relay out	15 ... 30 V dc	20.4 ... 115 V dc, 20.4 ... 250 V ac	20 ... 30 V dc
170 BDI 546 50	Discrete 16 in	74 ... 132 V ac	– –	85 ... 132 V ac
170 BDI 746 50	Discrete 16 in	170 ... 264.5 V ac	– –	170 ... 264.5 V ac
170 BDO 946 50	Discrete 16 out	– –	74 ... 253 V ac	85 ... 264.5 V ac
170 BAM 096 00	Analog 4 in/2 out	+/– 10 V dc 0 ... 10 V dc 0 ... 20 mA dc Pt 100	+/– 10 V dc 0 ... 20 mA dc	20 ... 30 V dc
170 BDI 356 00	Discrete 32 in	15 ... 30 V dc	– –	20 ... 30 V dc
170 BDO 356 00	Discrete 32 out	– –	20 ... 30 V dc	20 ... 30 V dc

Network Specifications

General specifications of InterBus-S networks are as follows.

Parameter	Specifications
Number of Distributed I/O Stations	256 maximum
Remote Bus Segment Cable Length	400 m maximum
Total System Expansion	13 km maximum
Transmission Speed	500 kbits/s
Number of Input/Output Points	4096 maximum
Temperature Range, Operating	0 ... +55 °C
Humidity	75% average, 85% occasional, non-condensing
RFI Suppression	VDE 0871

1.7 Environmental Specifications

All TIO modules share the following environmental specifications. Detailed specifications for individual modules are contained in the chapters for the modules.

Environmental Characteristic	Specification
Safety Class	VDE 0106, IEC 536: Class 1
Safety Type	IEC 529: IP20
Temperature Range (Operating)	EN 60721: 0 ... 60 °C
Temperature Range (Storage)	EN 60721: –40 ... +85 °C
Relative Humidity	EN 60721 Class F: 95% for 30 days per year 85% for remaining days per year 75% average per year without condensation
Atmospheric Pressure (Operating/Storage)	700 hPa (700 mbar)
Atmospheric Pressure (Transport)	230 hPa (230 mbar)
Pollutants	Maximum @ 60% relative humidity, without condensation: $SO_2 \leq 0.5$ ml/m^3 IEC 68–2–42 $H_2S < 0.1$ ml/m^3 IEC 68–2–43
Shock Load	EN 60068–2–27: 15 g (147 m/s^2) for 11 ms 3 shocks each direction per axis
Vibration Load	EN 60068–2–6: 0.15 mm single amplitude @ 10 ... 55 Hz 2 g (19.6 m/s^2) @ 55 Hz
Dielectric Strength	Conforms to IEC 664 (VDE 0160 5/88)

Chapter 2
Installing TIO Modules

- ☐ Setting the Modbus Plus Node Address
- ☐ Mounting on a DIN Rail or Panel
- ☐ Selecting Connectors and Bus Bars
- ☐ Inserting Coding Keys Into Connectors

2.1 Setting the Modbus Plus Node Address

2.1.1 Applicable Modules

This procedure applies only to modules for the Modbus Plus network. If you are installing a module for connection to an InterBus-S network, this information does not apply.

2.1.2 Setting the Modbus Plus Node Address

Modules are factory-preset with a network node address of 0 (zero). You must assign each module its intended address for your application.

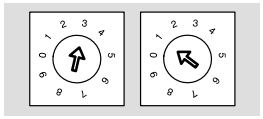
If you do not know the assigned address for the module, do not proceed with the installation. Contact your Modbus Plus network administrator and obtain the module's address before proceeding. Do not connect the module to your network until you have this information.

When you know the assigned address for the module, set the two rotary switches on the top of the module to the assigned address.

Setting the Modbus Plus Node Address

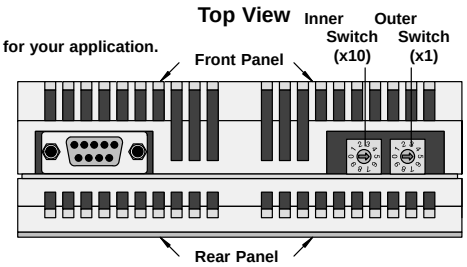
Do not install any module unless you have set its Modbus Plus address for your application.

See your network administrator to get the Modbus Plus node address for this module.



This example sets the address to 31.

Node Address	Inner Switch	Outer Switch
1 ... 9	0	1 ... 9
10 ... 19	1	0 ... 9
20 ... 29	2	0 ... 9
30 ... 39	3	0 ... 9
40 ... 49	4	0 ... 9
50 ... 59	5	0 ... 9
60 ... 64	6	0 ... 4



Warning! Modbus Plus is a network which can offer either deterministic I/O servicing, or non-deterministic multi-function servicing of I/O, Programming, MMI, and third party ModConnect devices.

Users are cautioned that unintended operation may result if proper network architecture and installation issues are not considered. For additional information, refer to the *Modicon Modbus Plus Network I/O System Planning Guide,* publication 840 USE 104 00.

Please read the recommendations on the next page to ensure optimal performance for your application.

2.1.3 Network Design Options

You can design your network to provide deterministic timing for servicing the I/O nodes that are controlling your machine or process. You can also design it for non-deterministic timing between nodes performing a variety of functions. Your options are outlined below.

2.1.4 Deterministic I/O Servicing

When using Modbus Plus as an I/O network, the CPU or NOM modules must be set to the lowest addresses, followed immediately by the I/O drop addresses. For truly deterministic I/O servicing do not connect any other kinds of devices on the network. In addition, do not add or delete nodes from the network while the machine or process is running.

2.1.5 Multi-Function Servicing

Modbus Plus networks can be used for communication among many kinds of node devices. You should be aware of each device's requirement for access to the network. You should also be aware of the impact each device will have on the timing of your network communication, including the servicing of I/O nodes.

Programmers

Programmers may be connected to the network. However, caution must be used when adding or deleting these devices as this may cause an interruption in I/O servicing. The duration of this interruption depends greatly on the number of nodes on the network and their assigned addresses. In general, the lower the addresses on the network the shorter the interruption will be. In addition, the use of programmers may add to the token rotation time of the network. For example, Modsoft can add up to 6 milliseconds.

Man Machine Interfaces (MMI)

MMI devices typically communicate with the CPUs on a periodic polled basis, which generates network traffic that may vary over time. Therefore, to ensure proper I/O servicing, it is important to understand the worst case traffic these devices can generate. Typically an MMI adds 6 milliseconds to the token rotation time.

ModConnect Devices

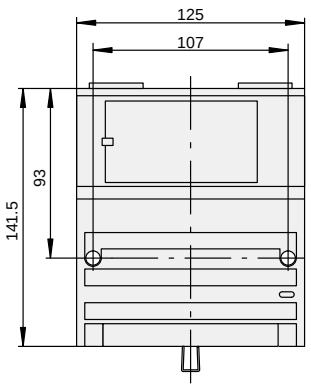
Many third party devices exist which may be attached to a Modbus Plus network. To ensure proper performance, it is important that the user understands the impact these devices have on token rotation time. Please consult the appropriate Vendor's literature.

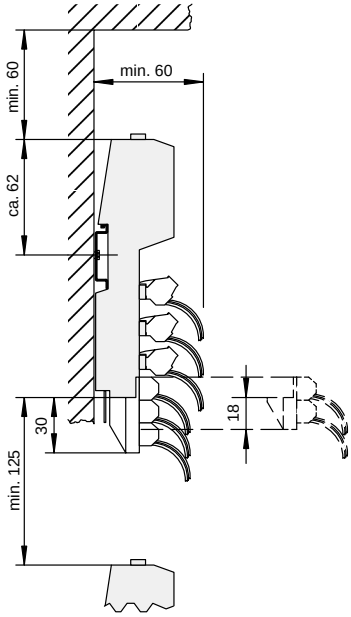
2.2 Mounting on a DIN Rail or Panel

TIO modules are designed for mounting on a standard DIN rail or vertical panel surface. Mounting dimersions are shown below.

When mounting a module, take care to maintain the proper minimum clearances for air circulation.

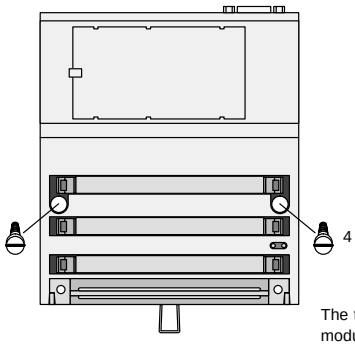
Dimensions (mm)





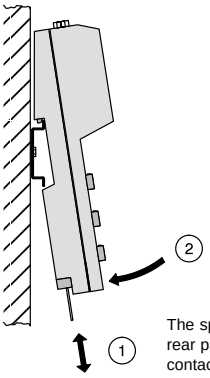
Clearances shown are the minimum required for proper air circulation.

Mounting on a Panel



The two mounting screws make the module's grounding contact to the panel.

Mounting on a DIN Rail



The spring terminal on the module's rear panel makes the grounding contact to the DIN rail.

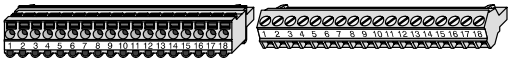
2.3 Selecting Connectors and Bus Bars

2.3.1 Availability of Connectors and Bus Bars

Field wiring connectors and bus bars are available separately from the TIO modules. They are not shipped with the modules.

Connectors and bus bars are available in configurations with spring terminals or screw terminals. Part numbers are shown below.

Selecting Connectors



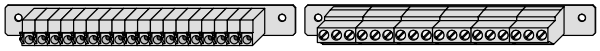
Connector with spring terminals | Connector with screw terminals

One connector is required for each row of terminals that you will connect to your module's operating voltages and field devices. Connectors are available with spring or screw terminals.

Part Numbers (each part number supplies 3 connectors):

170 XTS 002 00	Spring (Kit of 3)	170 XTS 001 00	Screw (Kit of 3)

Selecting Bus Bars



Bus bar with spring terminals | Bus bar with screw terminals

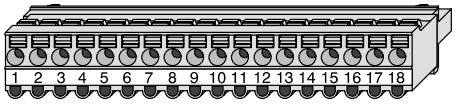
The bus bar at module row 4 provides a common connection for field devices. Its terminals are connected internally. There is no connection to the module. Bus bars are available in 1 ... 3 rows with spring or screw terminals.

Part Numbers (each part number supplies 1 bus bar):

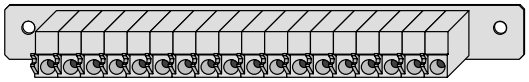
170 XTS 007 00	Spring, 1 Row	170 XTS 006 00	Screw, 1 Row
170 XTS 008 00	Spring, 2 Rows	170 XTS 005 00	Screw, 2 Rows
170 XTS 003 00	Spring, 3 Rows	170 XTS 004 00	Screw, 3 Rows

2.3.2 Spring Terminals

On connectors and bus bars with spring terminals, each terminal accepts one or two wires of up to 14 AWG (1.5 mm^2). Spring terminals are intended for use with solid wires.



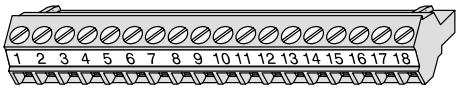
Connector (Spring Terminals)



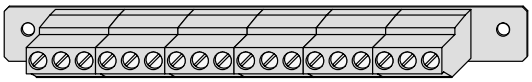
Bus Bar (Spring Terminals)

2.3.3 Screw Terminals

On connectors and bus bars with screw terminals, each terminal accepts one or two wires of up to 12 AWG (2.5 mm^2). Screw terminals can be used for either solid or stranded wires.



Connector (Screw Terminals)



Bus Bar (Screw Terminals)

2.4 Inserting Coding Keys Into Connectors

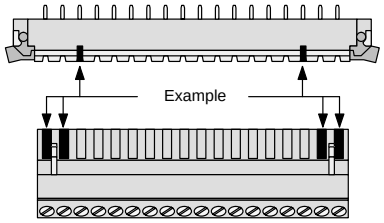
Field wiring connectors are supplied with an assortment of coding keys that allow you to customize the mounting of connectors to each module. This prevents the misconnection of field wiring to modules during installation and servicing.

Each module has a series of slots into which you can insert one or more coding keys. Each connector has a similar series of slots. When the keys are inserted into the same slot positions in both the module and the connector, the connector cannot be physically connected to the module.

By inserting coding keys into selected slots, you can ensure that each connector will mate at only one position on a specific module in your application.

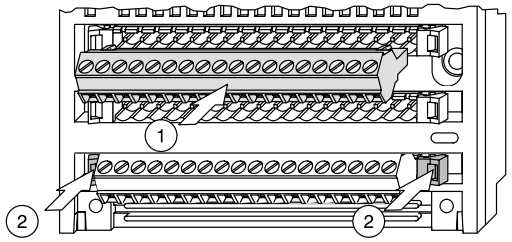
Inserting Coding Keys into the Connectors

Coding keys can be inserted into the module and connector slots.



The use of coding keys ensures that each connector can be inserted only into its correct module and slot. See your system administrator for coding details.

Inserting or Removing Connectors



Handle connectors only when power is not present. Insert connectors by pressing them into the module (1). Remove connectors by pressing the two end tabs (2).

You should create a plan for uniquely keying each type of module in your application. For example, use a separate coding scheme for each type of module: AC input, AC output, DC input, DC output, each type of analog module, and each type of special purpose module.

2.5 Connecting to the Modbus Plus Network

Modules on the Modbus Plus network will have one cable connection. This is to the drop cable from the network tap at the module site.

You should plan to provide a complete cabling diagram for your network installation, showing the cable routing path and methods of securing the cable. Your diagram should identify the drop cable at each module site.

Network Cable Connection

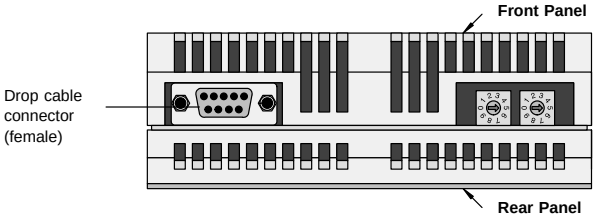
Modbus Plus Tap

990 NAD 230 00	Modbus Plus Tap

Pre-Assembled Drop Cables

990 NAD 211 10	Drop Cable, 2.4 m / 8 ft
990 NAD 211 30	Drop Cable, 6 m / 20 ft

Top View



Modicon provides pre-fabricated Modbus Plus drop cables in two lengths. Each cable has a connector installed on one end for direct connection to the module. The other end has open wires for connection to the Modbus Plus network tap.

2.6 Connecting to the InterBus-S Remote Bus

Modules at inline sites on the InterBus-S remote bus cable will have two connections. One connection is to the incoming bus cable, and the other is to the outgoing bus cable.

Modules at end sites on the network cable will have one connection. This is to the incoming bus cable only.

You should plan to provide a complete cabling diagram for your network installation, showing the cable routing path and methods of securing the cable. Your diagram should identify incoming and outgoing cables at each module site.

Network Cable Connections

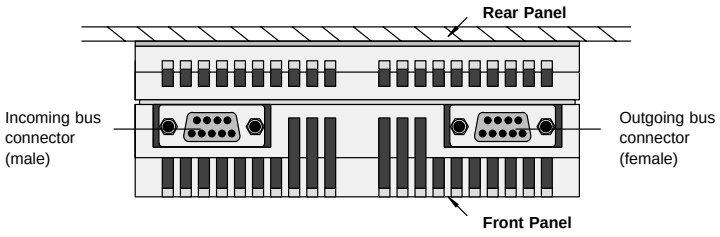
Pre-Assembled Cables

170 MCI 005 00	Cable, 5 cm
170 MCI 020 00	Cable, 20 cm
170 MCI 100 00	Cable, 100 cm

Connector Kit

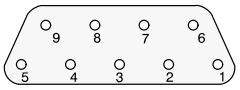
170 XTS 009 00	Connector Kit (contains 1 male and 1 female connector)

Top View



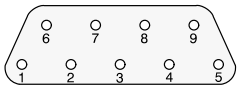
Modicon provides pre-fabricated InterBus-S cables in three lengths. Each cable has two connectors installed for direct interconnection between two modules. Modicon also provides a connector kit for installation onto user-supplied cable. The kit contains one male and one female connector. Recommended cable is: Belden 8103 or equivalent.

Connectors on TIO Module



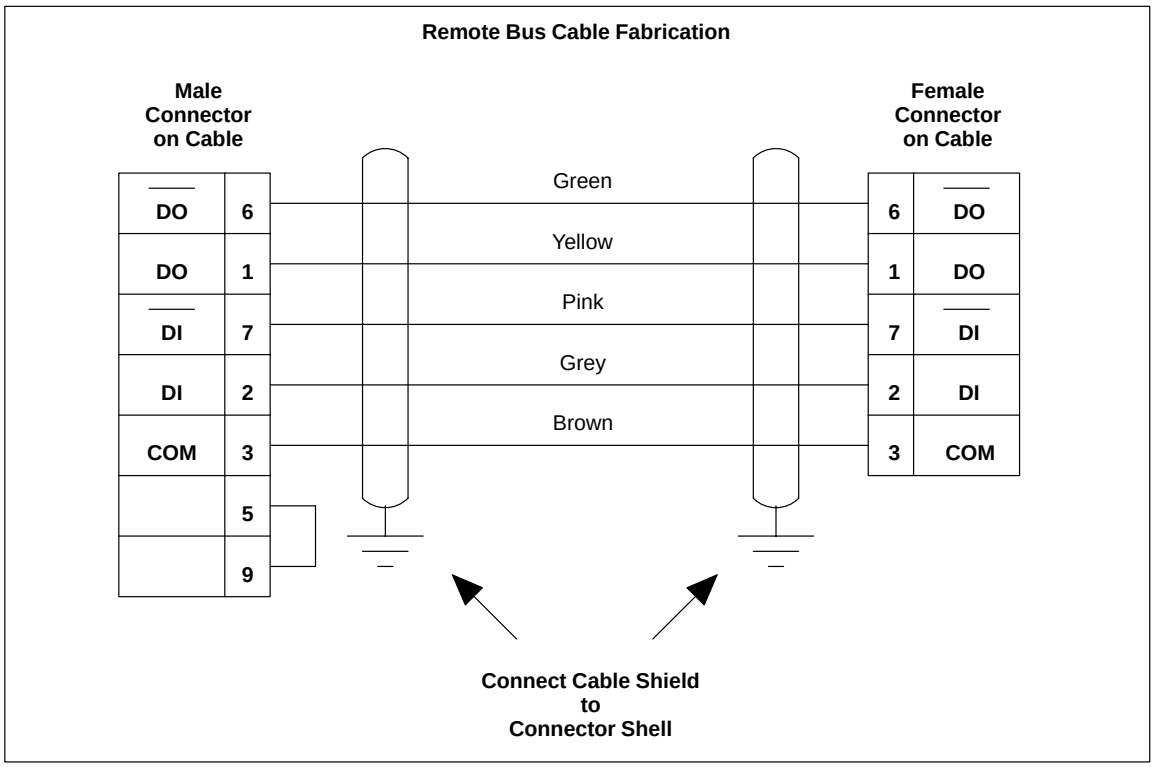
Remote Bus IN (Male)

Pin	Wire Color	Connection	
1	Yellow	DO	Data Out
2	Grey	DI	Data In
3	Brown	Common	
6	Green	$\overline{DO}$	Data Out Negated
7	Pink	$\overline{DI}$	Data In Negated
4, 5, 8, 9	– –	Not used	



Remote Bus OUT (Female)

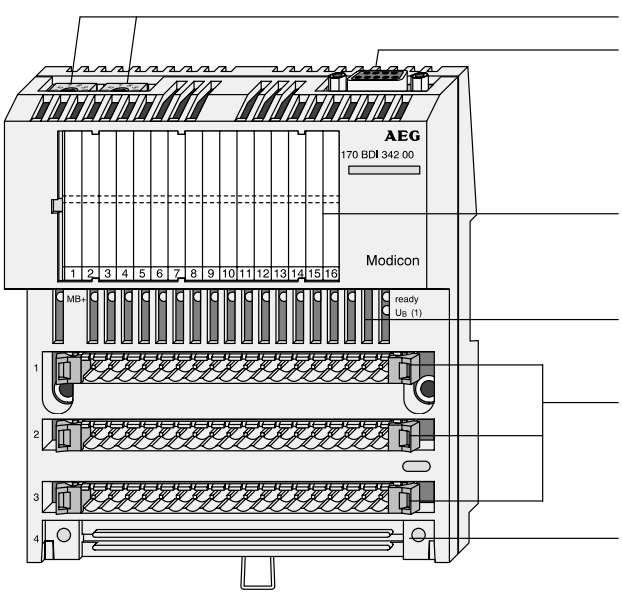
Pin	Wire Color	Connection	
1	Yellow	DO	Data Out
2	Grey	DI	Data In
3	Brown	Common	
6	Green	$\overline{DO}$	Data Out Negated
7	Pink	$\overline{DI}$	Data In Negated
5 – 9	(Jumper)	Jumper in connector only	
4, 8	– –	Not used	


Remote Bus Cable Fabrication
Male Connector on Cable
Female Connector on Cable
DO 6
DO 1
DI 7
DI 2
COM 3
5
9
Green
Yellow
Pink
Grey
Brown
6 DO
1 DO
7 DI
2 DI
3 COM
Connect Cable Shield to Connector Shell

170 BDI 342 00
Modbus Plus TIO
24 VDC 16 Input Module

Module Type	16 discrete input points, in 1 group
Nominal Input Voltage	24 V dc
Nominal Input Current, each point	4.2 mA

Front View



Modbus Plus address switches

Modbus Plus connector

Label for identifying field wiring connections

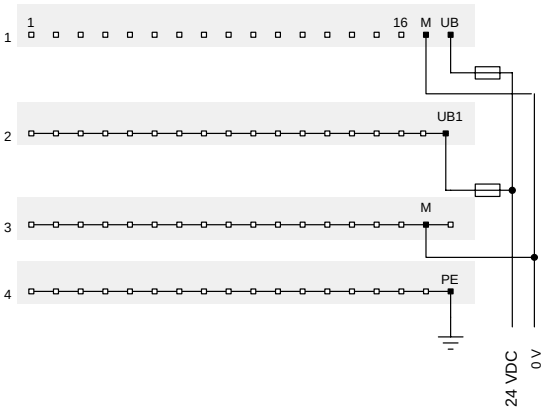
LED area

Mounting slots for terminal strip connectors

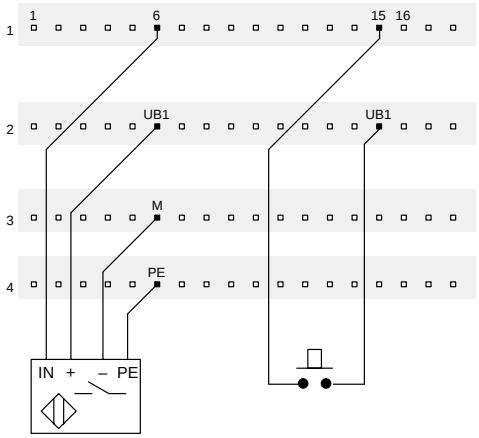
Mounting slot for bus bar connector

Field Wiring Connections

Connecting Operating Voltages



Connecting Field Devices



Common Connections

Row 2: Terminals 1 ... 18 (UB1) are connected together within the module.

Row 3: Terminals 1 ... 18 (M) are connected together within the module.

Row 4: Install an external bus bar at row 4. Terminals 1 ... 18 (PE) are connected together within the external bus bar. There is no connection to the module.

External Fuses

UB supply: 200 mA fast blow.

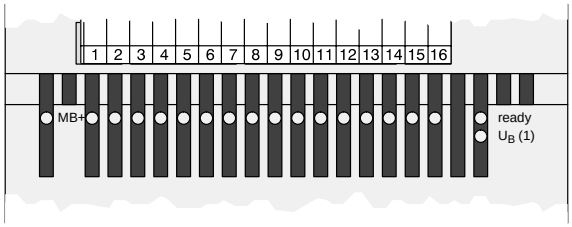
UB1 supply: Select a fuse that meets the total supply requirement of the connected devices. The maximum allowable fuse rating is: 4 A fast blow.

Labeling of Terminals

Row	Terminal	Connection	
1	1 ... 16	I1 ... I16	Input points 1 ... 16
1	17	M	Voltage return
1	18	UB	Module operating voltage
2	18	UB1	Voltage for field devices
3	17	M	Voltage return
4	18	PE	Earth ground for field devices

LED Indicators

LED Indicators



LED	Status	Meaning
ready	green	The module is ready to communicate on the network.
	off	The module is not ready. Check the UB voltage source.
UB(1)	green	UB1 voltage is present.
	off	UB1 voltage is not present. Check the UB1 source.
1 ... 16	green	Input 1 ... 16 is active (input voltage high level).
	off	Input 1 ... 16 is not active (input voltage low level).
MB+	6 flashes/s	This is the normal operating state for the node. It is receiving and passing the network token. All nodes on a healthy network flash this pattern.
	1 flash/s	The node is offline just after power-up or after exiting the 4 flashes/s mode. In this state, the node monitors the network and builds a table of active nodes. After being in this state for 5 s, the node attempts to go to its normal operating state, indicated by 6 flashes/s.
	2 flashes, then off for 2 s	The node detects the token being passed among the other nodes, but never receives the token. Check the network for an open circuit or defective termination.
	3 flashes, then off for 1.7 s	The node is not detecting any tokens being passed among the other nodes. It periodically claims the token but cannot find another node to which to pass it. Check the network for an open circuit or defective termination.
	4 flashes, then off for 1.4 s	The node has detected a valid message from a node using a network address identical to its own address. The node remains in this state for as long as it continues to detect the duplicate address. If the duplicate address is not detected for 5 s, the node changes to its 1 flash/s mode.
	off	The Modbus Plus network is not active.

Specifications

The **DC Input 24 Vdc 1x16** Sink module accepts 24 Vdc inputs and is for use with source output devices.

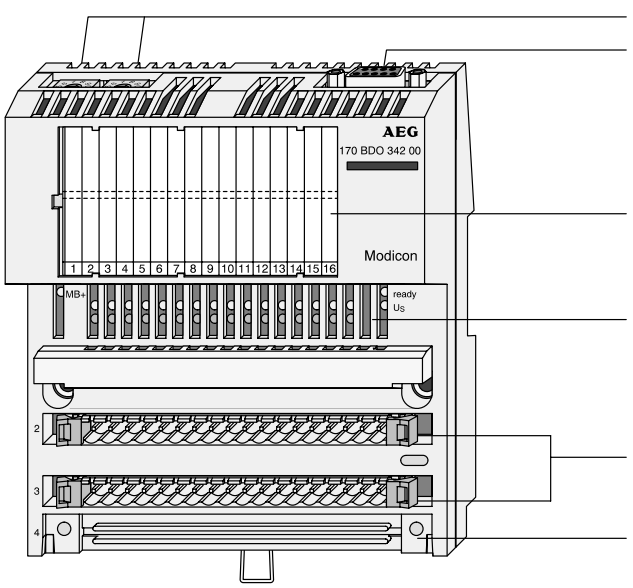
Specifications

Number of Input Points	16 in one group
Module Quiescent Current	100 mA @ 20 ... 30 Vdc
Operating Voltages and Currents	
Guaranteed ON (voltage)	+15 ... +30 Vdc
Guaranteed OFF (voltage)	–3 ... +5 Vdc
Guaranteed ON (current)	2.4 mA
Guaranteed OFF (current)	0.9 mA
Absolute Maximum Input	
Continuous	30 Vdc
1.3 ms	56 Vdc decaying pulse
Response	
OFF – ON	3 ms (max)
ON – OFF	3 ms (max)
Internal Resistance	5.6 k
Input Protection	Resistor limited
Isolation	
Point to Point	None
Group to Bus	500 Vac rms
Fault Detection	None
Fusing	
Internal	None
External	User discretion 4A max per group

170 BDO 342 00
Modbus Plus TIO
24 VDC 16 Output Module

Module Type	16 discrete output points, in 1 group
Nominal Output Voltage	24 V dc
Maximum Output Current, each point	0.5 A

Front View



Modbus Plus address switches

Modbus Plus connector

Label for identifying field wiring connections

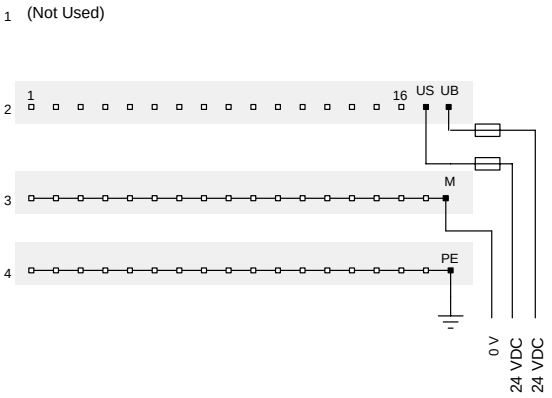
LED area

Mounting slots for terminal strip connectors

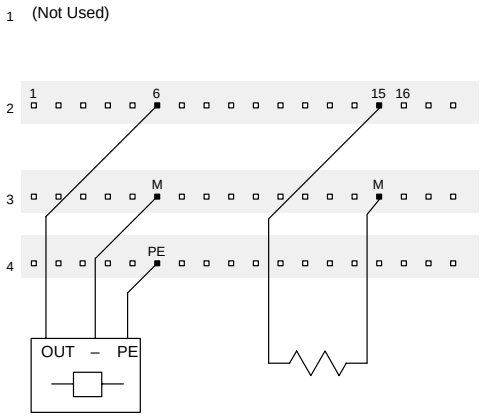
Mounting slot for bus bar connector

Field Wiring Connections

Connecting Operating Voltages



Connecting Field Devices



Common Connections

Row 3: Terminals 1 ... 18 (M) are connected together within the module.

Row 4: Install an external bus bar at row 4. Terminals 1 ... 18 (PE) are connected together within the external bus bar. There is no connection to the moudle.

Labeling of Terminals

Row	Terminal	Connection	
2	1 ... 16	O1 ... O16	Output points 1 ... 16
2	17	US	Voltage for field devices
2	18	UB	Module operating voltage
3	18	M	Voltage return
4	18	PE	Earth ground for field devices

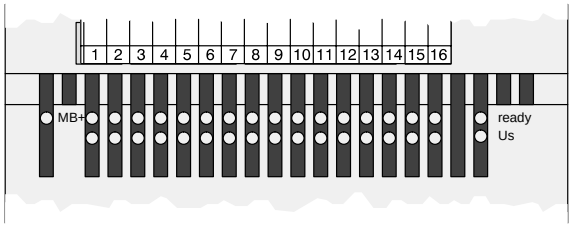
External Fuses

UB supply: 200 mA fast blow.

US supply: Select a fuse that meets the total supply requirement of the connected devices. The maximum allowable fuse rating is: 8 A fast blow.

LED Indicators

LED Indicators



LED	Status	Meaning
ready	green	The module is ready to communicate on the network.
	off	The module is not ready. Check the UB voltage source.
Us	green	US voltage is present.
	off	US voltage is not present. Check the US source.
1 ... 16 upper row	green	Output 1 ... 16 is active (output voltage high level).
	off	Output 1 ... 16 is not active (output voltage low level).
1 ... 16 lower row	red	Output 1 ... 16 has an error condition (overload or short circuit).
	off	Output 1 ... 16 is operating normally.
MB+	6 flashes/s	This is the normal operating state for the node. It is receiving and passing the network token. All nodes on a healthy network flash this pattern.
	1 flash/s	The node is offline just after power-up or after exiting the 4 flashes/s mode. In this state, the node monitors the network and builds a table of active nodes. After being in this state for 5 s, the node attempts to go to its normal operating state, indicated by 6 flashes/s.
	2 flashes, then off for 2 s	The node detects the token being passed among the other nodes, but never receives the token. Check the network for an open circuit or defective termination.
	3 flashes, then off for 1.7 s	The node is not detecting any tokens being passed among the other nodes. It periodically claims the token but cannot find another node to which to pass it. Check the network for an open circuit or defective termination.
	4 flashes, then off for 1.4 s	The node has detected a valid message from a node using a network address identical to its own address. The node remains in this state for as long as it continues to detect the duplicate address. If the duplicate address is not detected for 5 s, the node changes to its 1 flash/s mode.
	off	The Modbus Plus network is not active.

Specifications

The **DC Output 24 Vdc 1x16** module switches 24 Vdc outputs and is for use with source output devices.

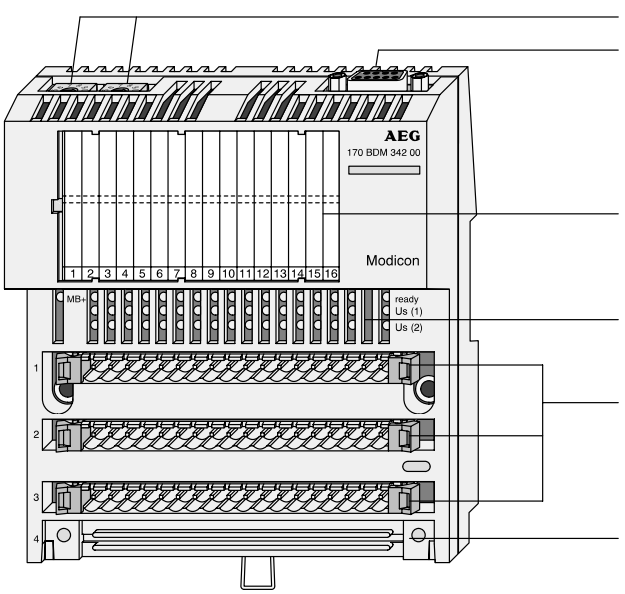
Specifications

Number of Output Points	16 in one group
Module Quiescent Current	100 mA @ 20 ... 30 Vdc
Voltage	
Operating	20 ... 30 Vdc
Absolute (max)	56 Vdc for 1.3 ms decaying voltage pulse
ON State Drop / Point	0.5 Vdc @ 0.5 A
Maximum Load Current	
Each Point	0.5 A
Per Module	8 A
OFF State Leakage / Point	0.4 mA @ 30 Vdc
Maximum Surge Current	
Each Point	5 A @ 500 µs duration (no more than 6 per minute)
Maximum Loading	
Each Point	12 W @ 100 cycles/s, resistive 12 W @ 1000 cycles/h, inductive 1.2 W @ 8 cycles/s, lamp
Load Capacitance Maximum	50 µf
Response Time	
OFF – ON	1 ms (max)
ON – OFF	1 ms (max)
Module Protection	
Input Protection	Resistor limited
Output Protection	Electronically protected
Isolation	
Group to Bus	500 Vac rms
Fault Detection	
Input	None
Output	Red LED indicator for each output
Fusing	
Input	I**nternal –** None **External –** User discretion
Output	**Internal –** None, electronically protected **External –** User discretion

170 BDM 342 00
Modbus Plus TIO
24 VDC 16 Input / 16 Output Module

Module Type	16 discrete input points, in 1 group 16 discrete output points, in 2 groups of 8 points
Nominal Operating Voltage	24 V dc
Nominal Input Current, each point	4.2 mA
Maximum Output Current, each point	0.5 A

Front View



Modbus Plus address switches

Modbus Plus connector

Label for identifying field wiring connections

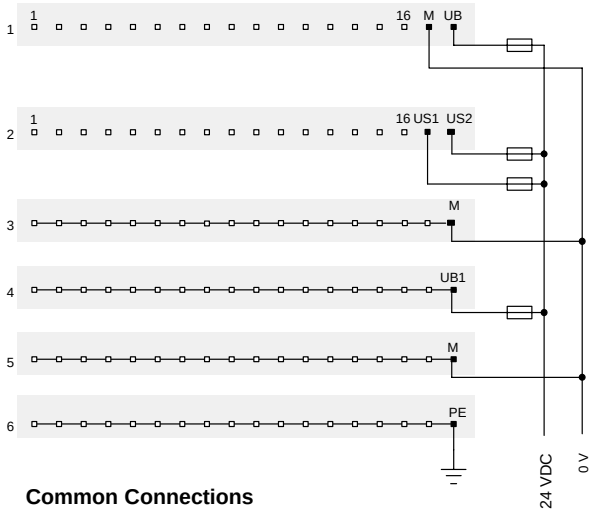
LED area

Mounting slots for terminal strip connectors

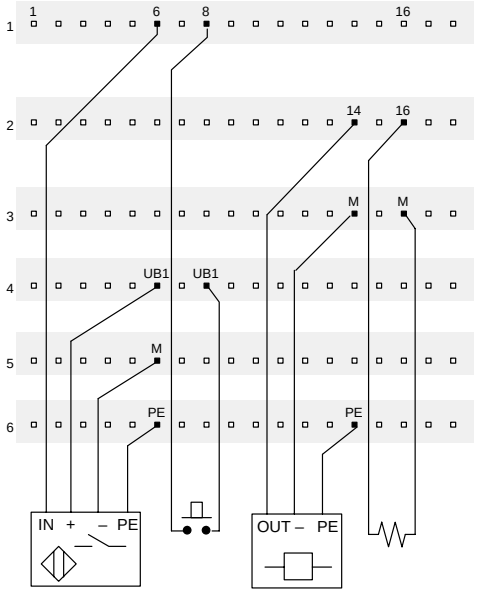
Mounting slot for bus bar connector

Field Wiring Connections

Connecting Operating Voltages



Connecting Field Devices



Common Connections

Row 3: Terminals 1 ... 18 (M) are connected together within the module.

External Bus Bar Connections

Row 4, 5, and 6: Install an external 3-row bus bar at row 4, and use the bus bar terminals for UB1, M, and PE field wiring.

Use row 4 for UB1 wiring connections.
Use row 5 for M wiring connections.
Use row 6 for PE wiring connections.

Terminals 1 ... 18 are connected together within each bus bar. There are no internal connections to the module.

External Fuses

UB supply: 200 mA fast blow.

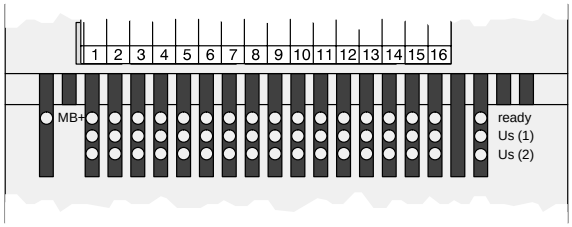
UB1, US1 and US2 supply: Select a fuse that meets the total supply requirement of the connected devices. The maximum allowable fuse rating is: 6.3 A fast blow.

Labeling of Terminals

Row	Terminal	Connection	
1	1 ... 16	I1 ... I16	Input points 1 ... 16
1	17	M	Module operating voltage return
1	18	UB	Module operating voltage
2	1 ... 8	O1 ... O8	Output points 1 ... 8 (group 1)
2	9 ... 16	O9 ... O16	Output points 9 ... 16 (group 2)
2	17	US1	Voltage for outputs 1 ... 8 (group 1)
2	18	US2	Voltage for outputs 9 ... 16 (group 2)
3	18	M	Voltage return for field devices
4	18	UB1	Voltage for inputs 1 ... 16
5	18	M	Voltage return for field devices
6	18	PE	Earth ground for field devices

LED Indicators

LED Indicators



LED	Status	Meaning
ready	green	The module is ready to communicate on the network.
	off	The module is not ready. Check the UB voltage source.
Us(1)	green	US1 voltage is present.
	off	US1 voltage is not present. Check the US1 source.
Us(2)	green	US2 voltage is present.
	off	US2 voltage is not present. Check the US2 source.
1 ... 16 upper row	green	Input 1 ... 16 is active (input voltage high level).
	off	Input 1 ... 16 is not active (input voltage low level).
1 ... 16 center row	green	Output 1 ... 16 is active (output voltage high level).
	off	Output 1 ... 16 is not active (output voltage low level).
1 ... 16 lower row	red	Output 1 ... 16 has an error condition (overload or short circuit).
	off	Output 1 ... 16 is operating normally.
MB+	6 flashes/s	This is the normal operating state for the node. It is receiving and passing the network token. All nodes on a healthy network flash this pattern.
	1 flash/s	The node is offline just after power-up or after exiting the 4 flashes/s mode. In this state, the node monitors the network and builds a table of active nodes. After being in this state for 5 s, the node attempts to go to its normal operating state, indicated by 6 flashes/s.
	2 flashes, then off for 2 s	The node detects the token being passed among the other nodes, but never receives the token. Check the network for an open circuit or defective termination.
	3 flashes, then off for 1.7 s	The node is not detecting any tokens being passed among the other nodes. It periodically claims the token but cannot find another node to which to pass it. Check the network for an open circuit or defective termination.
	4 flashes, then off for 1.4 s	The node has detected a valid message from a node using a network address identical to its own address. The node remains in this state for as long as it continues to detect the duplicate address. If the duplicate address is not detected for 5 s, the node changes to its 1 flash/s mode.
	off	The Modbus Plus network is not active.

Specifications

The module's **DC Input 24 Vdc 1x16 Sink** inputs accept 24 V dc inputs for use with source output devices. The **DC Output 24 Vdc 2x8 Source** outputs switch 24 V dc for use with sink input devices.

Specifications (General)

Module Quiescent Current	100 mA @ 20 ... 30 Vdc
Module Protection	
Input Protection	Resistor limited
Output Protection	Electronically protected
Isolation (Input and Output)	
Point to Point	None
Group to Group	None
Group to Bus	500 Vac rms
Fault Detection	
Input	None
Output	Red LED indicator for each output
Fusing	
Input	I**nternal –** None **External –** User discretion
Output	**Internal –** None, electronically protected **External –** User discretion

Specifications (Inputs)

Number of Input Points	16 in one group
Operating Voltages and Currents	
Guaranteed ON (voltage)	+15 ... +30 Vdc
Guaranteed OFF (voltage)	–3 ... +5 Vdc
Guaranteed ON (current)	2.4 mA
Guaranteed OFF (current)	0.9 mA
Absolute Maximum Input	
Continuous	30 Vdc
1.3 ms	56 Vdc decaying pulse
Internal Resistance (Input)	5.6 k
Response (Input)	
OFF – ON	3 ms max
ON – OFF	3 ms max

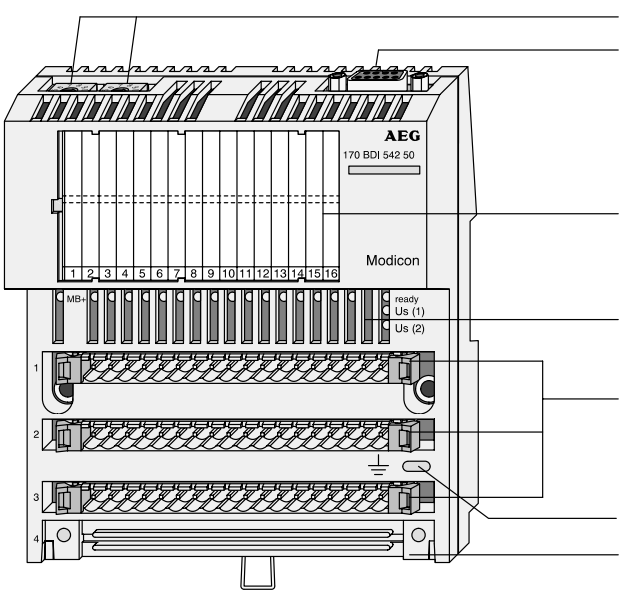
Specifications (Outputs)

Number of Output Points	16 in two 8 point groups
Voltage (Output)	
Operating (max)	19.2 ... 30 Vdc
Absolute (max)	56 Vdc for 1.3 ms decaying voltage pulse
ON State Drop / Point	0.5 Vdc @ 0.5 A
Maximum Load Current	
Each Point	0.5 A
Each Group	4 A
Per Module	8 A
Off State Leakage / Point	0.4 mA @ 30 Vdc
Maximum Loading	
Each Point	12 W @ 100 cycles/s, resistive 12 W @ 1000 cycles/h, inductive 1.2 W @ 8 cycles/s, lamp
Load Capacitance Maximum	50 µf
Response (Output)	
OFF – ON	1 ms max (resistive load)
ON – OFF	1 ms max (resistive load)

170 BDI 542 50
Modbus Plus TIO
115 VAC 16 Input Module

Module Type	16 discrete input points, in 2 groups of 8 points
Nominal Input Voltage	115 V ac
Nominal Input Current, each point	10 mA

Front View



Modbus Plus address switches

Modbus Plus connector

Label for identifying field wiring connections

LED area

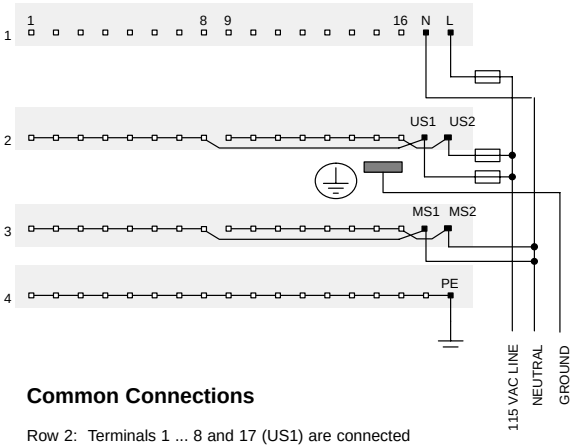
Mounting slots for terminal strip connectors

Lug for ground wire

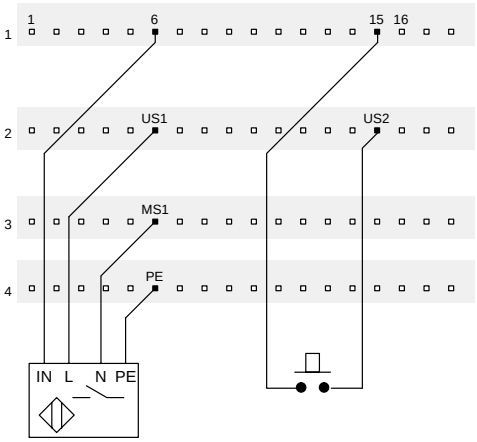
Mounting slot for bus bar connector

Field Wiring Connections

Connecting Operating Voltages



Connecting Field Devices



Common Connections

Row 2: Terminals 1 ... 8 and 17 (US1) are connected together within the module.

Row 2: Terminals 9 ... 16 and 18 (US2) are connected together within the module.

Row 3: Terminals 1 ... 8 and 17 (MS1) are connected together within the module.

Row 3: Terminals 9 ... 16 and 18 (MS2) are connected together within the module.

Row 4: Install an external bus bar at row 4. Terminals 1 ... 18 (PE) are connected together within the external bus bar. There is no connection to the module.

External Fuses

L supply: 100 mA fast blow.

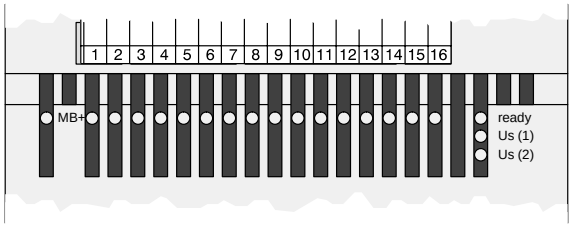
US1 and US2 supply: Select a fuse that meets the total supply requirement of the connected devices. The maximum allowable fuse rating is: 4 A fast blow.

Labeling of Terminals

Row	Terminal	Connection	
1	1 ... 8	I1 ... I8	Input points 1 ... 8 (group 1)
1	9 ... 16	I9 ... I16	Input points 9 ... 16 (group 2)
1	17	N	Module operating voltage, Neutral
1	18	L	Module operating voltage, Line
2	17	US1	Voltage for devices 1 ... 8 (group 1)
2	18	US2	Voltage for devices 9 ... 16 (group 2)
3	17	MS1	Voltage return for 1 ... 8 (group 1)
3	18	MS2	Voltage return for 9 ... 16 (group 2)
4	18	PE	Earth ground for field devices
	⏚		Power ground

LED Indicators

LED Indicators



LED	Status	Meaning
ready	green	The module is ready to communicate on the network.
	off	The module is not ready. Check the L voltage source.
Us (1)	green	US1 voltage is present.
	off	US1 voltage is not present. Check the US1 source.
Us (2)	green	US2 voltage is present.
	off	US2 voltage is not present. Check the US2 source.
1 ... 16	green	Input 1 ... 16 is active (input voltage high level).
	off	Input 1 ... 16 is not active (input voltage low level).
MB+	6 flashes/s	This is the normal operating state for the node. It is receiving and passing the network token. All nodes on a healthy network flash this pattern.
	1 flash/s	The node is offline just after power-up or after exiting the 4 flashes/s mode. In this state, the node monitors the network and builds a table of active nodes. After being in this state for 5 s, the node attempts to go to its normal operating state, indicated by 6 flashes/s.
	2 flashes, then off for 2 s	The node detects the token being passed among the other nodes, but never receives the token. Check the network for an open circuit or defective termination.
	3 flashes, then off for 1.7 s	The node is not detecting any tokens being passed among the other nodes. It periodically claims the token but cannot find another node to which to pass it. Check the network for an open circuit or defective termination.
	4 flashes, then off for 1.4 s	The node has detected a valid message from a node using a network address identical to its own address. The node remains in this state for as long as it continues to detect the duplicate address. If the duplicate address is not detected for 5 s, the node changes to its 1 flash/s mode.
	off	The Modbus Plus network is not active.

Specifications

The **AC Input 115 Vac 2x8** module accepts 115 Vac inputs.

Specifications

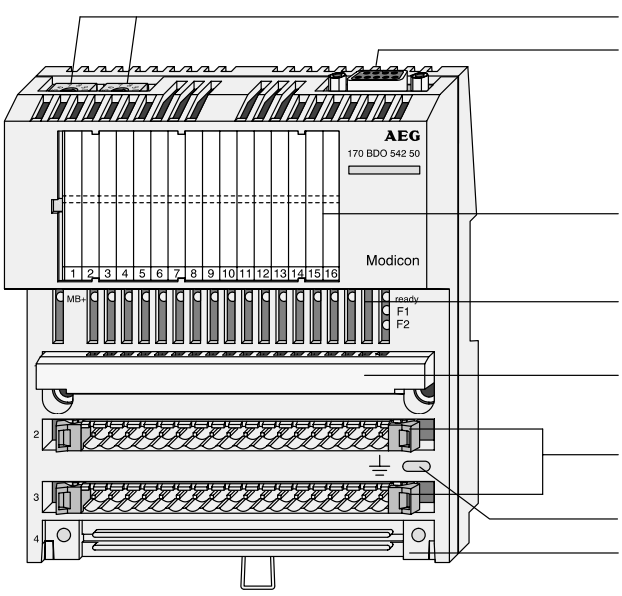
Number of Input Points	16 in two 8 point groups
Module Quiescent Current	40 mA @ 85 ... 264.5 Vac
Input Voltage and Currents Ranges	
Voltage	Guaranteed ON: 74 Vac Guaranteed OFF: 20 Vac
Current	Guaranteed ON: 10 mA Guaranteed OFF: 2 mA
Input Frequency	47 ... 63 Hz
Absolute Maximum Input	
Continuous	132 Vac
10 s	156 Vac
1 cycle	200 Vac
1.3 ms	276 Vac
Response	
OFF – ON	Min: 4.9 ms Max: 0.75 line cycle
ON – OFF	Min: 7.3 ms Max: 12.3 ms
Isolation	
Input to Input	All inputs in a group must be from the same phase of line input voltage
Group to Group	1780 Vac rms for 1 minute
Input to Bus	1780 Vac rms for 1 minute
Fault Detection	None
Fusing	
Internal	None
External	User discretion

☞ **Note:** Input signals must be sinusoidal with less than 6% THD.

170 BDO 542 50
Modbus Plus TIO
24 ... 230 VAC 16 Output Module

Module Type	16 discrete output points, in 2 groups of 8 points
Nominal Output Voltage	24 ... 230 V ac
Maximum Output Current, each point	0.5 A rms

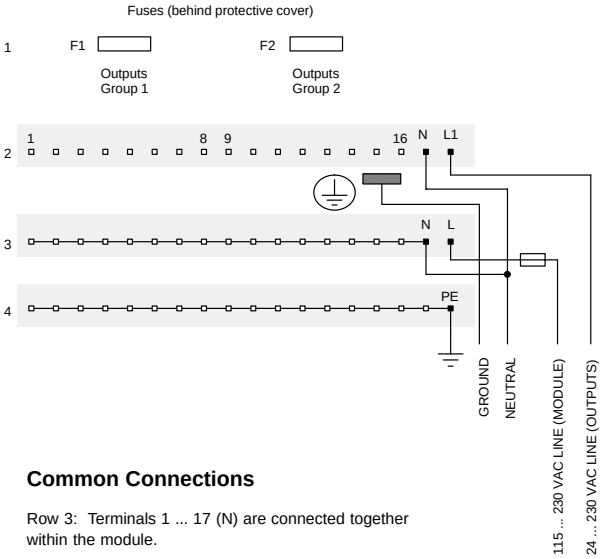
Front View



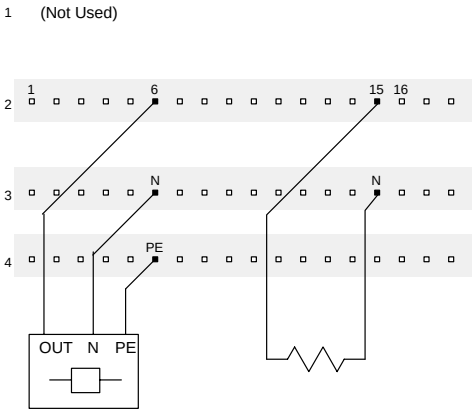
Modbus Plus address switches
Modbus Plus connector
Label for identifying field wiring connections
LED area
Protective cover (Fuses located inside)
Mounting slots for terminal strip connectors
Lug for ground wire
Mounting slot for bus bar connector

Field Wiring Connections

Connecting Operating Voltages



Connecting Field Devices



Common Connections

Row 3: Terminals 1 ... 17 (N) are connected together within the module.

Row 4: Install an external bus bar at row 4. Terminals 1 ... 18 (PE) are connected together within the external bus bar. There is no connection to the module.

Internal Fuses

L1 supply: 6.3 A 250 V fast blow, for each output group.
Total fuses: 2.

External Fuse

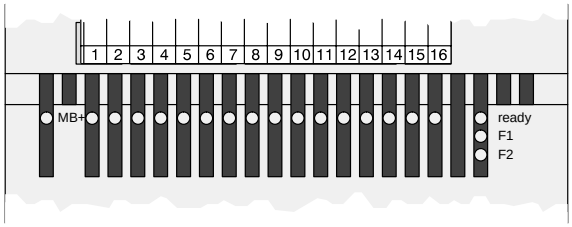
L supply: 100 mA 250 V fast blow.

Labeling of Terminals

Row	Terminal	Connection	
2	1 ... 8	O1 ... O8	Output points 1 ... 8 (group 1)
2	9 ... 16	O9 ... O16	Output points 9 ... 16 (group 2)
2	17	N	Voltage for field devices, Neutral
2	18	L1	Voltage for field devices, Line
3	17	N	Module operating voltage, Neutral
3	18	L	Module operating voltage, Line
4	18	PE	Earth ground for field devices
	⏚		Power ground

LED Indicators

LED Indicators



LED	Status	Meaning
ready	green	The module is ready to communicate on the network.
	off	The module is not ready. Check the L voltage source.
F1	green	Fuse F1 (group 1 outputs) is OK.
	off	Fuse F1 is not OK.
F2	green	Fuse F2 (group 2 outputs) is OK.
	off	Fuse F2 is not OK.
1 ... 16	green	Output 1 ... 16 is active (output voltage high level).
	off	Output 1 ... 16 is not active (output voltage low level).
MB+	6 flashes/s	This is the normal operating state for the node. It is receiving and passing the network token. All nodes on a healthy network flash this pattern.
	1 flash/s	The node is offline just after power-up or after exiting the 4 flashes/s mode. In this state, the node monitors the network and builds a table of active nodes. After being in this state for 5 s, the node attempts to go to its normal operating state, indicated by 6 flashes/s.
	2 flashes, then off for 2 s	The node detects the token being passed among the other nodes, but never receives the token. Check the network for an open circuit or defective termination.
	3 flashes, then off for 1.7 s	The node is not detecting any tokens being passed among the other nodes. It periodically claims the token but cannot find another node to which to pass it. Check the network for an open circuit or defective termination.
	4 flashes, then off for 1.4 s	The node has detected a valid message from a node using a network address identical to its own address. The node remains in this state for as long as it continues to detect the duplicate address. If the duplicate address is not detected for 5 s, the node changes to its 1 flash/s mode.
	off	The Modbus Plus network is not active.

Specifications

The **AC Output 24 ... 230 Vac 2x8** module switches 24 ... 230 Vac powered loads.

Specifications

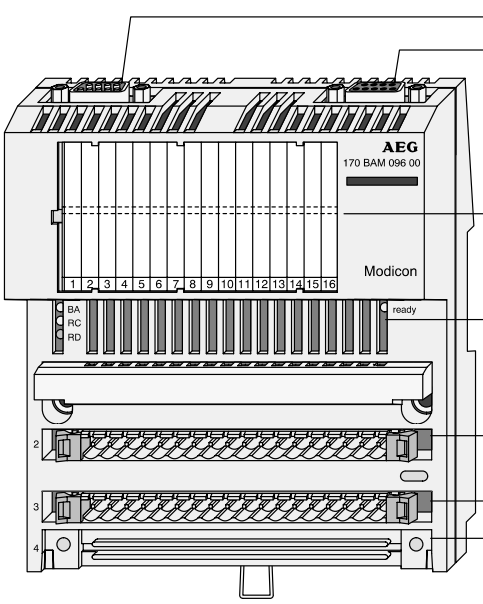
Number of Output Points	16 in two 8 point groups
Module Quiescent Current	40 mA @ 85 ... 264.5 Vac
Output Voltage (rms)	
Working	20.4 ... 253 Vac
Absolute Maximum	300 Vac for 10 s 400 Vac for 1 cycle
Frequency	47 ... 63 Hz
ON State Drop / Point	1.5 Vac max
Minimum Load Current (rms)	10 mA
Maximum Load Current (rms)	
Each Point	0.5 A continuous, 20.4 ... 253 Vac rms
Per Module	8 A continuous
Off State Leakage / Point (max)	3.75 mA

Surge Current Maximum (rms)	
One Cycle	15 A per point
Two Cycles	10 A per point
Three Cycles	5 A per point
Applied DV / DT	400 V/µs
Commutative DV / DT	5 V/µs
Response	
OFF – ON	0.50 of one line cycle max
ON – OFF	0.50 of one line cycle max
Output Protection (internal)	RC snubber suppression
Isolation (rms)	
Output to Output	300 Vac for 1 minute
Output to Bus	1780 for 1 minute
Fusing	
Internal	One 6.3 A 250 V fuse per group
External	User discretion

170 BAM 096 00
InterBus–S TIO
Analog Input/Output Module

Module Type	4 analog inputs, 2 analog outputs
Nominal Input Ranges	0 ... 10 V, ±10 V, 0 ... 20 mA (see Specifications)
Nominal Output Ranges	±10 V, 0 ... 20 mA (see Specifications)

Front View



InterBus–S incoming remote bus

InterBus–S outgoing remote bus

Label for identifying field wiring connections

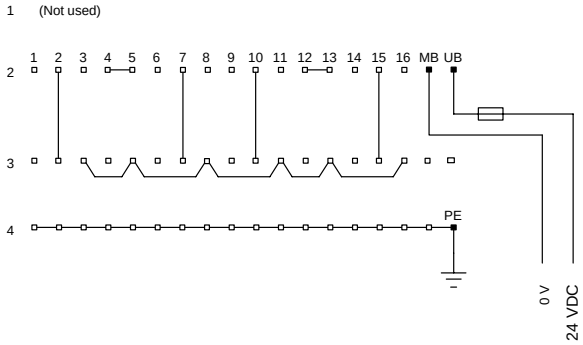
LED area

Mounting slots for terminal strip connectors

Mounting slot for bus bar connector

Field Wiring Connections

Connecting Operating Voltages



Connecting Field Devices

(See wiring examples on following pages.)

Common Connections

Row 2: Terminals 4 and 5 (I) are connected together within the module.

Row 2: Terminals 12 and 13 (I) are connected together within the module.

Rows 2 and 3: The following pairs of terminals (I+) on both rows are connected within the module: 2–2, 7–7, 10–10, and 15–15.

Row 3: The following terminals (AG) are connected together within the module: 3, 5, 8, 11, 13, and 16.

Row 4: Install an external bus bar at row 4. Terminals 1 ... 18 (PE) are connected together within the external bus bar. There is no connection to the module.

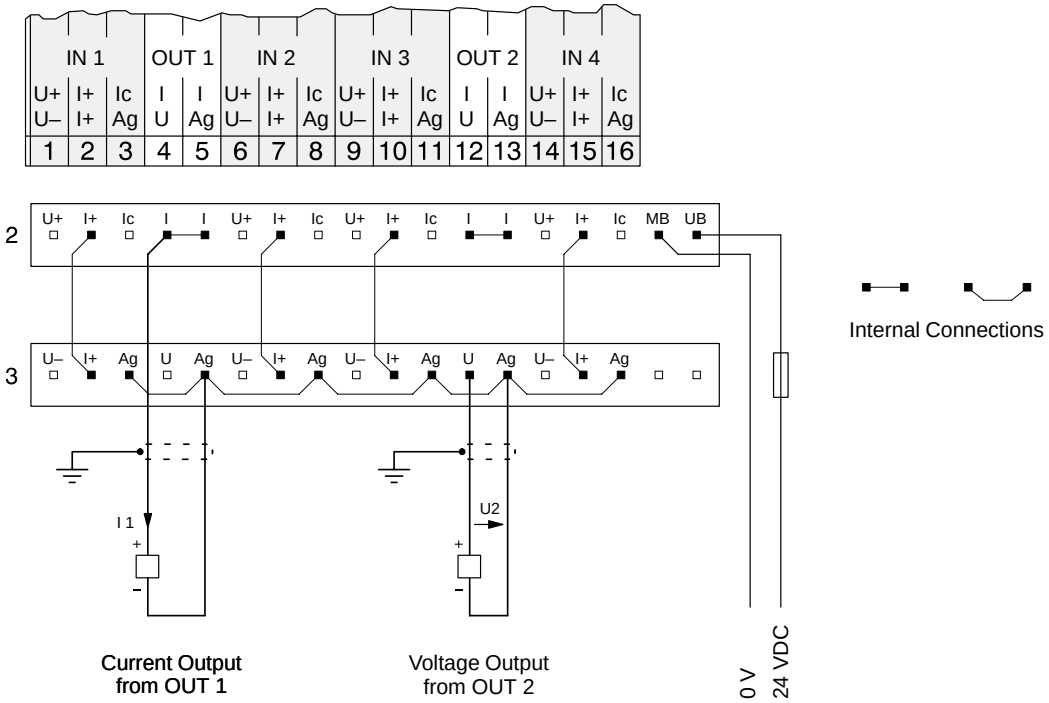
External Fuses

UB supply: 1 A fast blow.

Labeling of Terminals

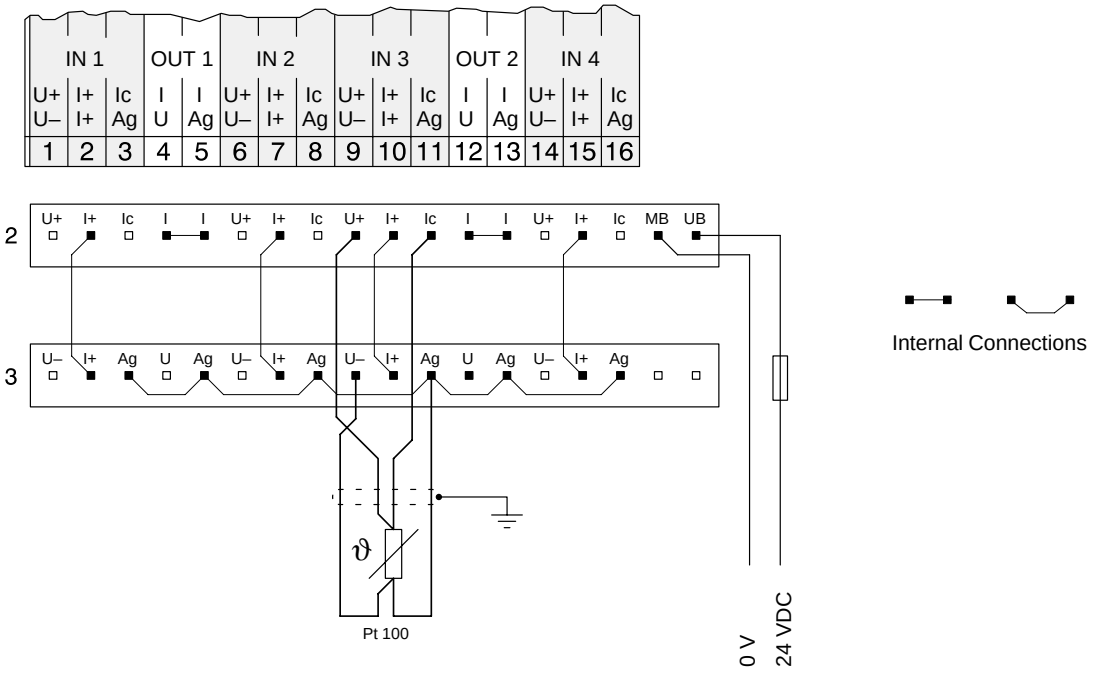
Row	Terminal	Connection	
2	1	U+	+ Voltage input, sensor 1
3	1	U–	– Voltage input, sensor 1
2, 3	2	I+	Current input, sensor 1
2	3	IC	Constant current to Pt100, sensor 1
2	4, 5	I	Constant current out, sensor 1
3	4	U	Voltage out to sensor 1
2	6	U+	+ Voltage input, sensor 2
3	6	U–	– Voltage input, sensor 2
2, 3	7	I+	Current input, sensor 2
2	8	IC	Constant current to Pt100, sensor 2
2	9	U+	+ Voltage input, sensor 3
3	9	U–	– Voltage input, sensor 3
2, 3	10	I+	Current input, sensor 3
2	11	IC	Constant current to Pt100, sensor 3
2	14	U+	+ Voltage input, sensor 4
3	14	U–	– Voltage input, sensor 4
2, 3	15	I+	Current input, sensor 4
2	16	IC	Constant current to Pt100, sensor 4
2	17	MB	Module operating voltage return
2	18	UB	Module operating voltage
3	3, 5, 8, 11, 13, 16	AG	Analog ground for field devices
4	18	PE	Earth ground for field devices

Wiring Example: 2-Wire Current Output and Voltage Output Devices



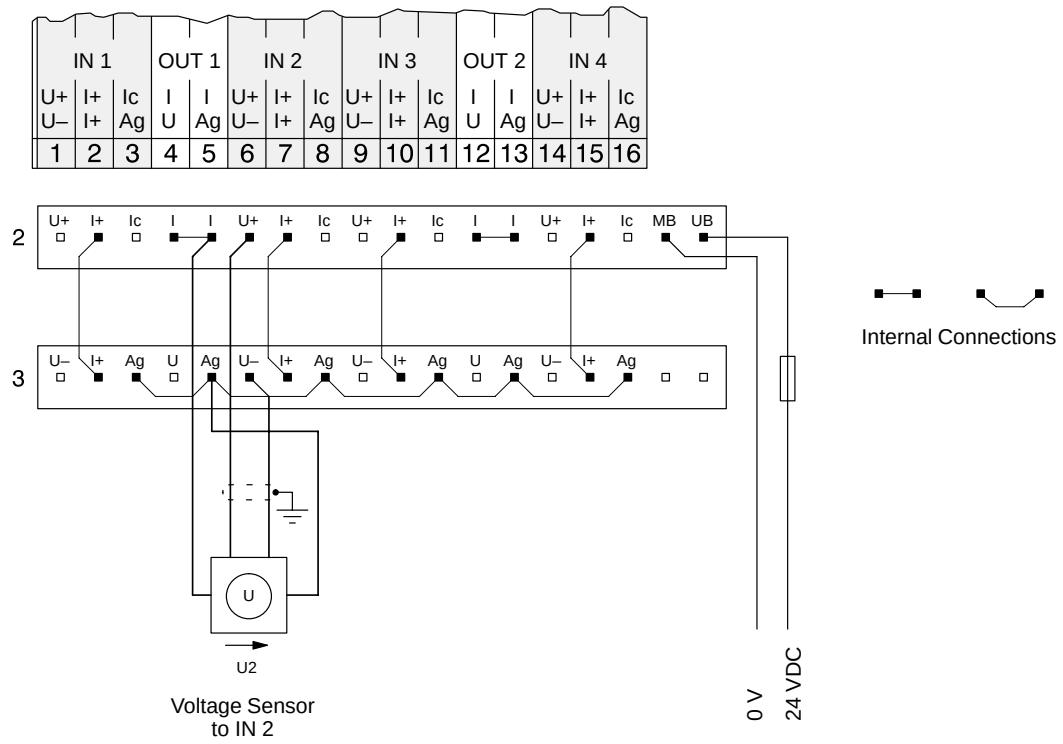
Ag = Analog ground
I = Current output to current device
U = Positive voltage output to voltage device

Wiring Example: Pt100 Sensor Input



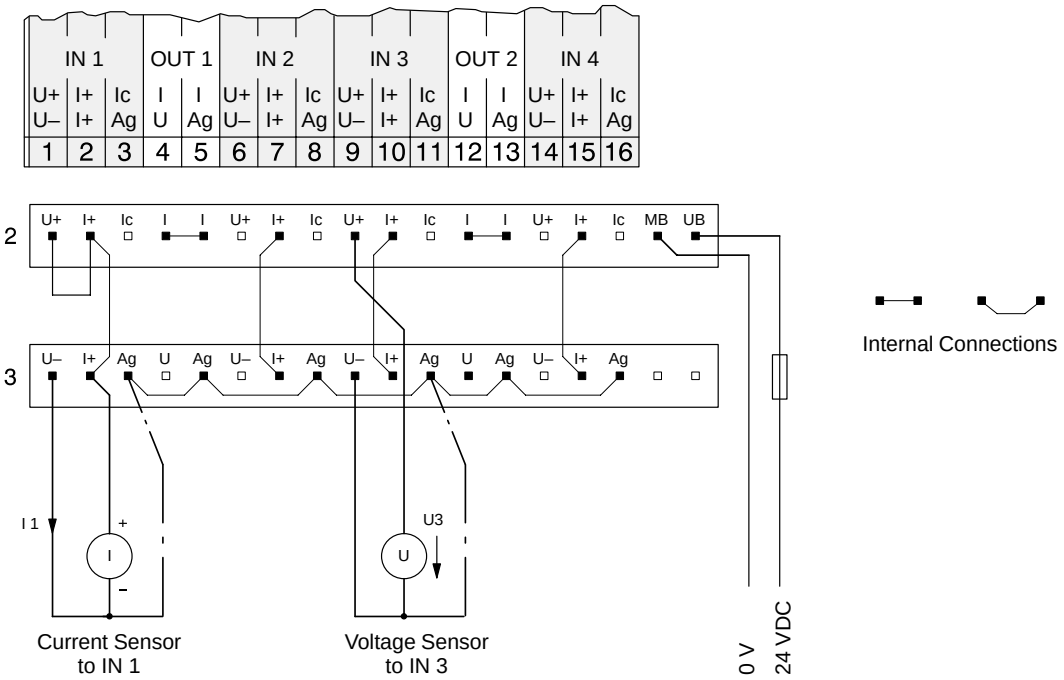
Ag = Analog ground
Ic = Constant current output to Pt100
U+ = Positive differential voltage input from Pt100
U– = Negative differential voltage input from Pt100

Wiring Example: 4-Wire Sensor Input



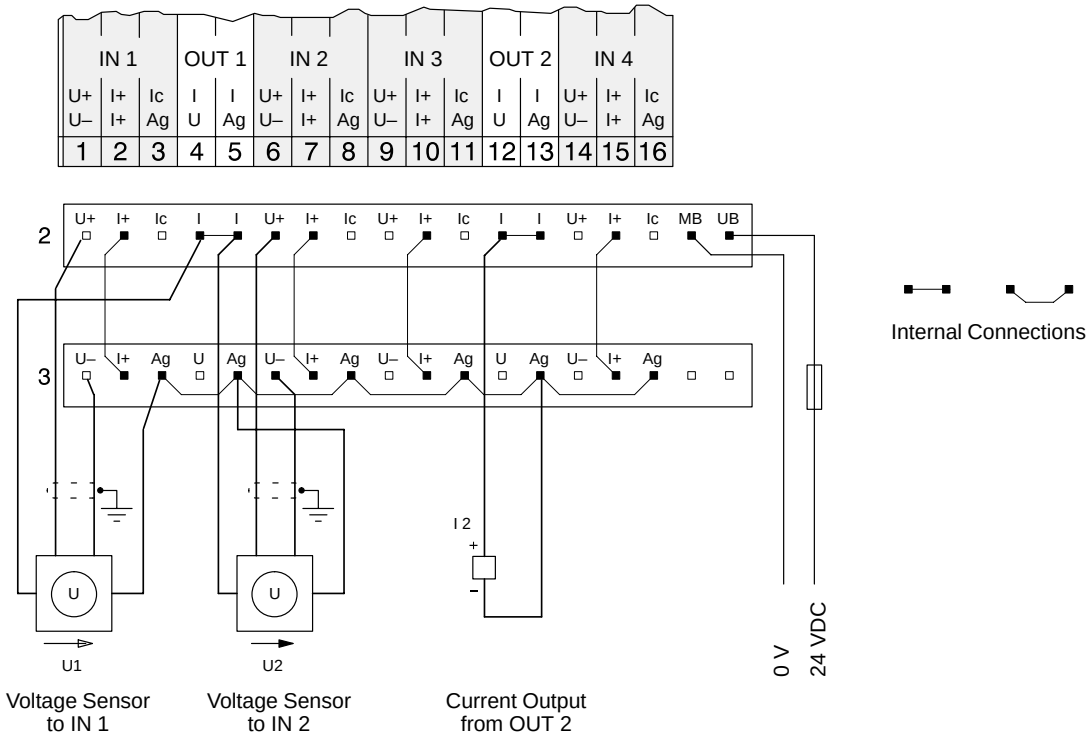
Ag = Analog ground
I = Constant current output to sensor
U+ = Positive differential voltage input from sensor
U– = Negative differential voltage input from sensor

Wiring Example: 2-Wire and 3-Wire Sensor Inputs



Ag = Analog ground (for 3-wire sensors only)
I+ = Current input from current sensor
U+ = Positive voltage input from voltage sensor
U– = Negative voltage input from voltage sensor

Wiring Example: Combination of 3-Wire Sensor Inputs and 2-Wire Output



Voltage Sensor to IN 1

Voltage Sensor to IN 2

Current Output from OUT 2

Ag = Analog ground
I (OUT1) = Current output supply to input sensors 1 and 2
U+ (IN1) = Positive voltage input from input sensor 1
U– (IN1) = Negative voltage input from input sensor1
U+ (IN2) = Positive voltage input from input sensor 2
U– (IN2) = Negative voltage input from input sensor 2
I (OUT2) = Current output to output device

When using the I (OUT1) output to supply the voltage input sensors as in this example, the same output circuit cannot be used to drive an output device.

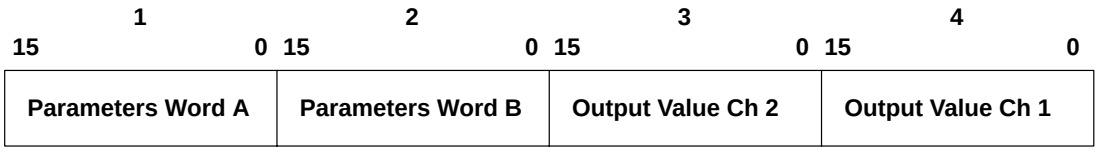
Register Allocation

The module receives four 16-bit words from the InterBus-S network, and transmits four 16-bit words to the network.

Received Words

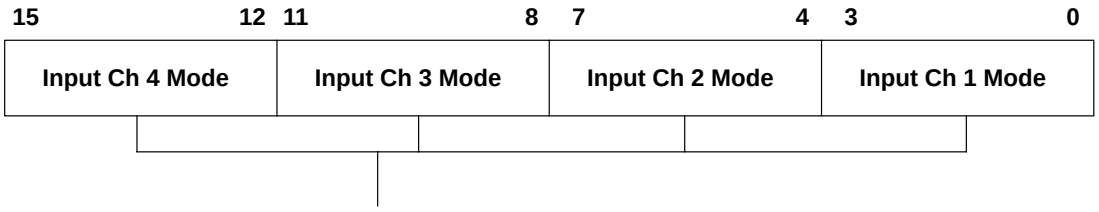
The first two received words specify control parameters for the module's input and output channels. The next two words specify the analog values for the two output channels.

Received Words



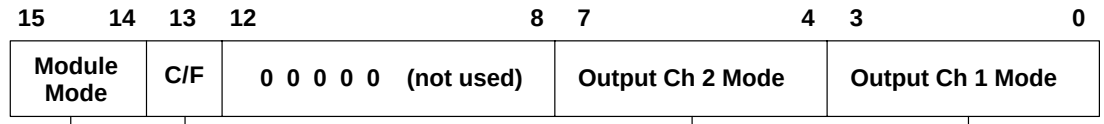
Word 1 is the first word received.

Parameters Word A



Ch 4, 3, 2, 1 Binary Value	Input Channel Mode
0 0 0 0	Channel Inactive (Default)
0 0 0 1	± 1 V
0 0 1 0	± 5 V or ± 20 mA
0 0 1 1	± 10 V
0 1 0 0	reserved
0 1 0 1	0 ... 1 V
0 1 1 0	0 ... 5 V or 0 ... 20 mA
0 1 1 1	0 ... 10 V
1 0 0 0	reserved
1 0 0 1	0.2 ... 1 V
1 0 1 0	1 ... 5 V or 4 ... 20 mA
1 0 1 1	2 ... 10 V
1 1 0 0	reserved
1 1 0 1	Pt100
1 1 1 0	reserved
1 1 1 1	reserved

Parameters Word B



0 = Celsius
1 = Fahrenheit

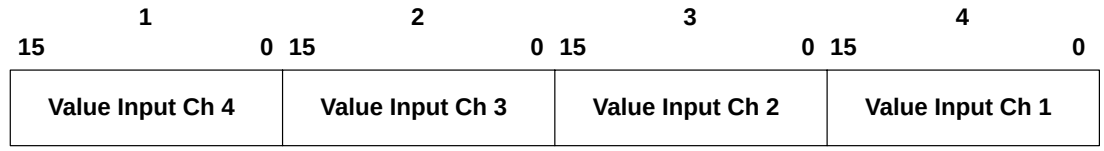
0 0	reserved
0 1	reserved
1 0	AEG Compatibility (REQUIRED)
1 1	reserved

Ch 2, 1 Binary Value	Output Channel Mode	Output Value on Bus Timeout
0 0 0 0	Channel Inactive (Default)	
0 0 0 1	0 ... 20 mA	0 mA
0 0 1 0	4 ... 20 mA	4 mA
0 0 1 1	± 10 V	0 V
0 1 0 0	reserved	
0 1 0 1	0 ... 20 mA	20 mA
0 1 1 0	4 ... 20 mA	20 mA
0 1 1 1	± 10 V	+ 10 V
1 0 0 0	reserved	
1 0 0 1	0 ... 20 mA	Hold Last Value
1 0 1 0	4 ... 20 mA	Hold Last Value
1 0 1 1	± 10 V	Hold Last Value
1 1 0 0	reserved	
1 1 0 1	reserved	
1 1 1 0	reserved	
1 1 1 1	reserved	

Transmitted Words

The four transmitted words contain the analog values for the signals received on the four input channels.

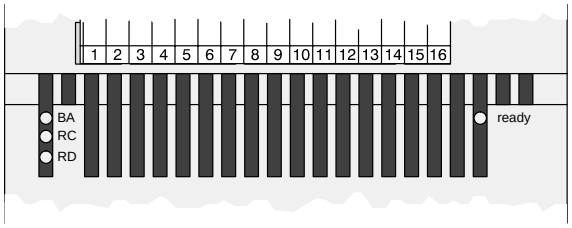
Transmitted Words



Word 1 is the first word transmitted.

LED Indicators

LED Indicators



LED	Status	Meaning
ready	green	The module is ready to communicate on the network.
	off	The module is not ready. Check the UB voltage source.
BA	green	Bus Active. The module is transmitting data messages on the network.
	off	The module is not transmitting data messages on the network.
RC	green	Remote Bus Check. The module's incoming bus is connected correctly, and the bus master device is not sending a bus reset signal.
	off	The incoming bus is not connected correctly, or the bus master device is sending a bus reset signal.
RD	red	Remote Bus Disabled. The module's outgoing bus is disabled.
	off	The module's outgoing bus is enabled.

Specifications

General Specifications

InterBus-S ID Code	0433 hexadecimal
Number of Channels	4 input, 2 output
Module Quiescent Current	120 mA @ 20 ... 30 Vdc
Power Dissipation	6 W
Isolation	
Channel to Channel	None
Channel to Bus	500 Vdc
Load Fault Detection	None

Input Specifications

Voltage and Pt100 Input	
Absolute Maximum Input	50 Vdc
Input Impedance	>20 MΩ
Current Input	
Absolute Maximum Input	25 mA
Input Impedance	250 Ω ± 0.03%
Accuracy @ 25°C (Voltage Mode)	Typical: ± 0.2% of full scale Maximum: ± 0.35% of full scale
Linearity	± 0.04 %
Accuracy Drift w/Temperature	Typical: +/– 0.0025% of full scale / °C Maximum: +/– 0.005% of full scale / °C
Common Mode Rejection	> –100 dB @ 50/60Hz
Update Time	270 ms for all channels (simultaneous update)
Repeatability	± 3 counts

Output Specifications

Accuracy	± 0.5% of full scale @ 25 °C, ± 0.9% of full scale, 0 ... 60 °C
Accuracy Drift w/Temperature	
Unipolar Ranges	0.003% of full scale /°C typical 0.005% of full scale /°C max
Bipolar Ranges	0.006% of full scale /°C typical 0.013% of full scale /°C max
Linearity	± 1 LSB
Maximum Settling Time	1 ms to ± 0.1% of the final value
Update Time	3 ms for all channels (simultaneous update)

Input Ranges and Values

Input Range	Input Values (Decimal)	Conversion Factor and Resolution	Example (Value/Conversion = Input)
0 ... 1 V	0 ... + 32000	32000 / V (15 bits)	32000 / 32000 = 1 V
0 ... 5 V	0 ... + 32000	6400 / V (14 bits)	32000 / 6400 = 5 V
0 ... 10 V	0 ... + 32000	3200 / V (15 bits)	32000 / 3200 = 10 V
0.2 ... 1 V	0 ... + 32000	(40000 / V) + 0.2 (15 bits)	(32000 / 40000) + 0.2 = 1 V
1 ... 5 V	0 ... + 32000	(8000 / V) + 1 (14 bits)	(32000 / 8000) + 1 = 5 V
2 ... 10 V	0 ... + 32000	(4000 / V) + 2 (15 bits)	(32000 / 4000) + 2 = 10 V
+/– 1 V	– 32000 ... + 32000	32000 / V (15 bits)	+ 32000 / 32000 = + 1 V
+/– 5 V	– 32000 ... + 32000	6400 / V (14 bits)	+ 32000 / 6400 = + 5 V
+/– 10 V	– 32000 ... + 32000	3200 / V (15 bits)	+ 32000 / 3200 = + 10 V
0 ... 20 mA	0 ... + 32000	1600 / mA (14 bits)	32000 / 1600 = 20 mA
4 ... 20 mA	0 ... + 32000	(2000 / mA) + 4 (14 bits)	(32000 / 2000) + 4 = 20 mA
+/– 20 mA	– 32000 ... + 32000	1600 / mA (14 bits)	+32000 / 1600 = + 20 mA
Pt100 °F	– 3280 ... + 15620	10 / °F (14 bits)	+ 15620 / 10 = + 1562 °F
Pt100 °C	– 5000 ... + 21250	25 / °C (14 bits)	+ 21250 / 25 = + 850 °C

Input Examples

0 ... 1 V	**0 ... 5 V**	**0 ... 10 V**	**Value (Decimal)**
– 0.004 V	– 0.02 V	– 0.04 V	– 128 (Underrange)
0 V	0 V	0 V	0
0.0005 V	0.0025 V	0.005 V	+ 16
1 V	5 V	10 V	+ 32000
1.0239 V	5.119 V	10.239 V	+ 32766 (Overrange)

0.2 ... 1 V	**1 ... 5 V**	**2 ... 10 V**	**Value (Decimal)**
0.1968 V	0.984 V	1.968 V	– 128 (Underrange)
0.2 V	1 V	2 V	0
0.2004 V	1.002 V	2.004 V	+ 16
1 V	5 V	10 V	+ 32000
1.019 V	5.095 V	10.19 V	+ 32766 (Overrange)

+/– 1 V	**+/– 5 V**	**+/– 10 V**	**Value (Decimal)**
– 1.0239 V	– 5.119 V	– 10.239 V	– 32766 (Underrange)
–1 V	– 5 V	– 10 V	– 32000
– 0.005 V	– 0.0025 V	– 0.005 V	– 16
0 V	0 V	0 V	0
0.005 V	0.0025 V	0.005 V	+ 16
1 V	5 V	10 V	+ 32000
1.0239 V	5.119 V	10.239 V	+ 32766 (Overrange)

0 ... 20 mA	4 ... 20 mA	+/– 20 mA	Value (Decimal)
...	...	–20.476 mA	– 32766 (Underrange)
...	...	– 20 mA	– 32000
...	...	– 0.01 mA	– 16
0 mA	4 mA	0 mA	0
0.01	4.008 mA	0.01 mA	+ 16
20 mA	20 mA	20 mA	+ 32000
20.476 mA	20.38 mA	20.476 mA	+ 32766 (Overrange)

Pt100 Fahrenheit	Value (Decimal)	Pt100 Celsius	Value (Decimal)
– 339 °F	– 3390 (Underrange)	– 206.6 °C	– 5165 (Underrange)
– 328 °F	– 3280	– 200 °C	– 5000
– 76 °F	– 760	– 60 °C	– 1500
– 0.1 °F	– 1	– 0.04 °C	– 1
0 °F	0	0 °C	0
0.1 °F	1	0.04 °C	+ 1
482 °F	4280	250 °C	+ 6250
1562 °F	15620	850 °C	+ 21250
1564 °F	15640 (Overrange)	851.2 °C	+ 21280 (Overrange)

Output Ranges and Values

Output Range	Output Values (Decimal)	Conversion Factor and Resolution	Example (Value/Conversion = Output)
+/– 10 V	– 32000 ... + 32000	V / 3200 (12 bits)	+ 32000 / 32000 = + 10 V
0 ... 20 mA	0 ... + 32000	ma / 1600 (12 bits)	32000 / 1600 = 20 mA
4 ... 20 mA	0 ... + 32000	(ma / 2000) + 4 (12 bits)	(32000 / 2000) + 4 = 20 mA

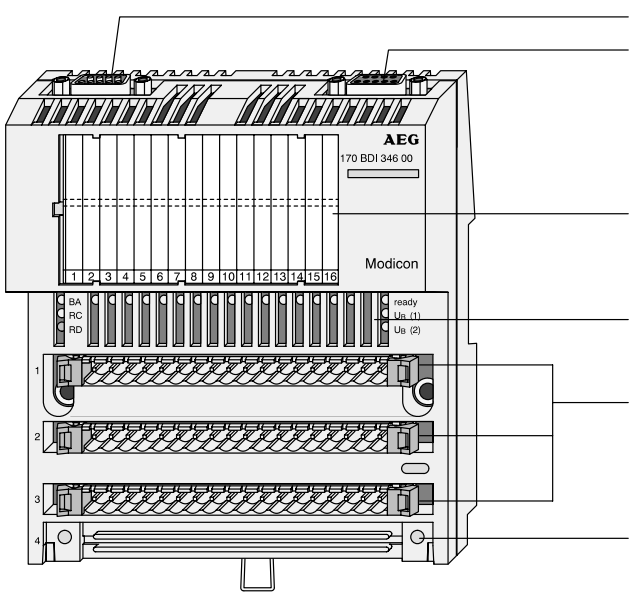
Output Examples

+/– 10 V	0 ... 20 mA	4 ... 20 mA	Value (Decimal)
– 10 V	...	...	– 32000
– 0.005 V	...	...	– 16
0 V	0 mA	4 mA	0
+ 0.005 V	0.01 mA	4.008 mA	+ 16
+ 10 V	20 mA	20 mA	+ 32000

170 BDI 346 00
Interbus–S TIO
24 VDC 16 Input Module

Module Type	16 discrete input points
Nominal Input Voltage	24 V dc
Nominal Input Current, each point	4.2 mA

Front View



Interbus–S incoming bus

Interbus–S outgoing bus

Label for identifying field wiring connections

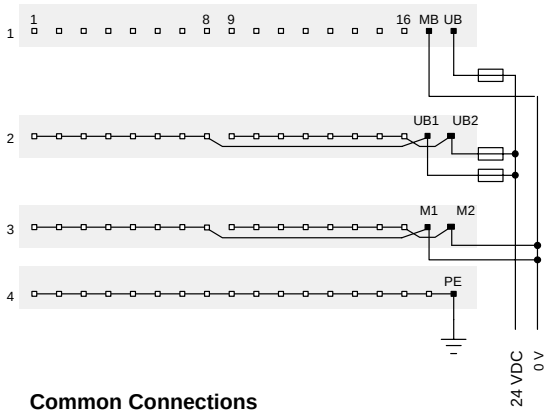
LED area

Mounting slots for terminal strip connectors

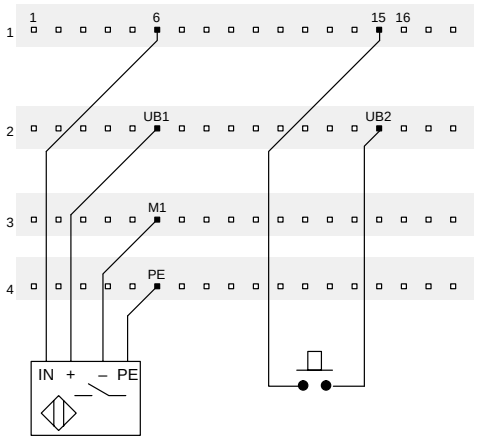
Mounting slot for bus bar connector

Field Wiring Connections

Connecting Operating Voltages



Connecting Field Devices



Common Connections

Row 2: Terminals 1 ... 8 and 17 (UB1) are connected together within the module.

Row 2: Terminals 9 ... 16 and 18 (UB2) are connected together within the module.

Row 3: Terminals 1 ... 8 and 17 (M1) are connected together within the module.

Row 3: Terminals 9 ... 16 and 18 (M2) are connected together within the module.

Row 4: Install an external bus bar at row 4. Terminals 1 ... 18 (PE) are connected together within the external bus bar. There is no connection to the module.

External Fuses

UB supply: 200 mA fast blow.

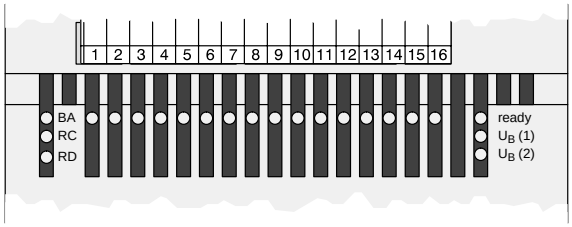
UB1 and UB2 supply: Select a fuse that meets the total supply requirement of the connected devices. The maximum allowable fuse rating is: 4 A fast blow.

Labeling of Terminals

Row	Terminal	Connection	
1	1 ... 16	I1 ... I16	Input points 1 ... 16
1	17	MB	Module operating voltage return
1	18	UB	Module operating voltage
2	17	UB1	Voltage for devices 1 ... 8
2	18	UB2	Voltage for devices 9 ... 16
3	17	M1	Voltage return, devices 1 ... 8
3	18	M2	Voltage return, devices 9 ... 16
4	18	PE	Earth ground for field devices

LED Indicators

LED Indicators



LED	Status	Meaning
ready	green	The module is ready to communicate on the network.
	off	The module is not ready. Check the UB voltage source.
BA	green	Bus Active. The module is transmitting data messages on the network.
	off	The module is not transmitting data messages on the network.
RC	green	Remote Bus Check. The module's incoming bus is connected correctly, and the bus master device is not sending a bus reset signal.
	off	The incoming bus is not connected correctly, or the bus master device is sending a bus reset signal.
RD	red	Remote Bus Disabled. The module's outgoing bus is disabled.
	off	The module's outgoing bus is enabled.
UB(1)	green	UB1 voltage is present.
	off	UB1 voltage is not present. Check the UB1 source.
UB(2)	green	UB2 voltage is present.
	off	UB2 voltage is not present. Check the UB2 source.
1 ... 16	green	Input 1 ... 16 is active (input voltage high level).
	off	Input 1 ... 16 is not active (input voltage low level).

Specifications

The **DC Input 24 Vdc 16-point** Sink module accepts 24 Vdc inputs and is for use with source output devices.

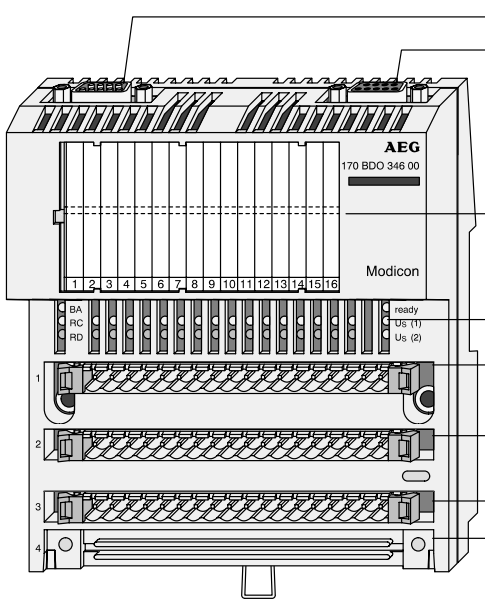
Specifications

InterBus-S ID Code	0102 hexadecimal
Number of Input Points	16
Module Quiescent Current	100 mA @ 20 ... 30 Vdc
Operating Voltages and Currents	
Guaranteed ON (voltage)	+15 ... +30 Vdc
Guaranteed OFF (voltage)	–3 ... +5 Vdc
Guaranteed ON (current)	2.4 mA
Guaranteed OFF (current)	0.9 mA
Absolute Maximum Input	
Continuous	30 Vdc
1.3 ms	56 Vdc decaying pulse
Response	
OFF – ON	3 ms (max)
ON – OFF	3 ms (max)
Internal Resistance	5.6 k
Input Protection	Resistor limited
Isolation	
Group to Group	None
Group to Bus	500 Vac rms for 1 minute
Fault Detection	None
Fusing	
Internal	None
External	User discretion 4A max per group

170 BDO 346 00
InterBus–S TIO
24 VDC 16 Output Module

Module Type	16 discrete output points
Nominal Output Voltage	24 V dc
Nominal Output Current, each point	0.5 A

Front View



InterBus–S incoming remote bus

InterBus–S outgoing remote bus

Label for identifying field wiring connections

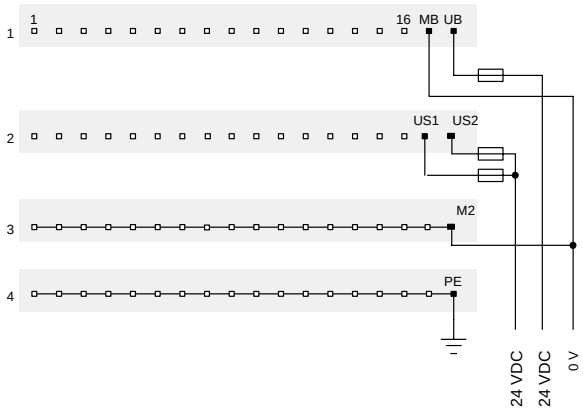
LED area

Mounting slots for terminal strip connectors

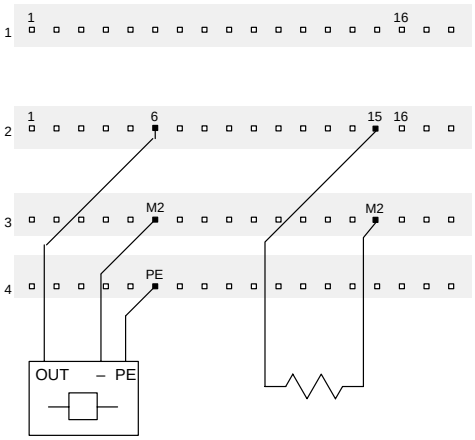
Mounting slot for bus bar connector

Field Wiring Connections

Connecting Operating Voltages



Connecting Field Devices



Common Connections

Row 3: Terminals 1 ... 18 (M2) are connected together within the module.

Row 4: Install an external bus bar at row 4. Terminals 1 ... 18 (PE) are connected together within the external bus bar. There is no connection to the module.

External Fuses

UB supply: 200 mA fast blow.

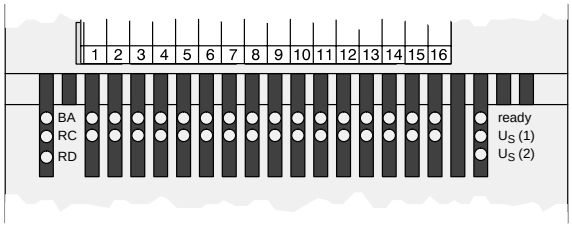
US1 and US2 supply: Select a fuse that meets the total supply requirement of the connected devices. The maximum allowable fuse rating is: 4 A fast blow.

Labeling of Terminals

Row	Terminal	Connection	
1	1 ... 16	Not used	
1	17	MB	Module operating voltage return
1	18	UB	Module operating voltage
2	1 ... 8	O1 ... O8	Output points 1 ... 8
2	9 ... 16	O9 ... O16	Output points 9 ... 16
2	17	US1	Voltage for devices 1 ... 8
2	18	US2	Voltage for devices 9 ... 16
3	18	M2	Voltage return, devices 1 ... 16
4	18	PE	Earth ground for field devices

LED Indicators

LED Indicators



LED	Status	Meaning
ready	green	The module is ready to communicate on the network.
	off	The module is not ready. Check the UB voltage source.
BA	green	Bus Active. The module is transmitting data messages on the network.
	off	The module is not transmitting data messages on the network.
RC	green	Remote Bus Check. The module's incoming bus is connected correctly, and the bus master device is not sending a bus reset signal.
	off	The incoming bus is not connected correctly, or the bus master device is sending a bus reset signal.
RD	red	Remote Bus Disabled. The module's outgoing bus is disabled.
	off	The module's outgoing bus is enabled.
US(1)	green	US1 voltage is present.
	off	US1 voltage is not present. Check the US1 source.
US(2)	green	US2 voltage is present.
	off	US2 voltage is not present. Check the US2 source.
1 ... 16 upper row	green	Output 1 ... 16 is active (output voltage high level).
	off	Output 1 ... 16 is not active (output voltage low level).
1 ... 16 lower row	red	Output 1 ... 16 has an error condition (overload or short circuit).
	off	Output 1 ... 16 is operating normally.

Specifications

The **DC Output 24 Vdc 16-point** module switches 24 Vdc outputs and is for use with sink input devices.

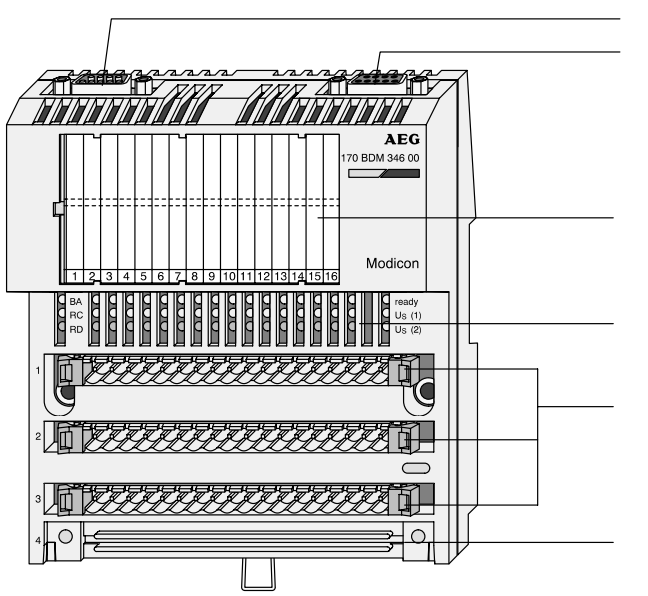
Specifications

InterBus-S ID Code	0101 hexadecimal
Number of Output Points	16
Module Quiescent Current	100 mA @ 20 ... 30 Vdc
Voltage (Output)	
Operating (max)	19.2 ... 30 Vdc
Absolute (max)	56 Vdc for 1.3 ms decaying voltage pulse
ON State Drop / Point	0.5 Vdc @ 0.5 A
Maximum Load Current	
Each Point	0.5 A
Each Group	4 A
Per Module	8 A
Off State Leakage / Point	0.4 mA @ 30 Vdc
Maximum Surge Current	
Each Point	5 A @ 500 µs duration (no more than 6 per minute)
Maximum Loading	
Each Point	12 W @ 100 cycles/hr, resistive 12 W @ 1000 cycles/hr, inductive 1.2 W @ 10 cycles/hr, lamp
Load Capacitance Maximum	50 µf
Response Time	
OFF – ON	1 ms (max)
ON – OFF	1 ms (max)
Module Protection	
Input Protection	Resistor limited
Output Protection	Electronically protected
Isolation (Input and Output)	
Group to Group	None
Group to Bus	500 V
Fault Detection	
Input	None
Output	Red LED indicator for each output
Fusing	
Input	I**nternal –** None **External –** User discretion
Output	**Internal –** None, electronically protected **External –** User discretion

170 BDM 346 00
InterBus–S TIO
24 VDC 16 Input / 16 Output Module

Module Type	16 discrete input points, in 1 group 16 discrete output points, in 2 groups of 8 points
Nominal Operating Voltage	24 V dc
Nominal Input Current, each point	4.2 mA
Maximum Output Current, each point	0.5 A

Front View



InterBus–S incoming remote bus

InterBus–S outgoing remote bus

Label for identifying field wiring connections

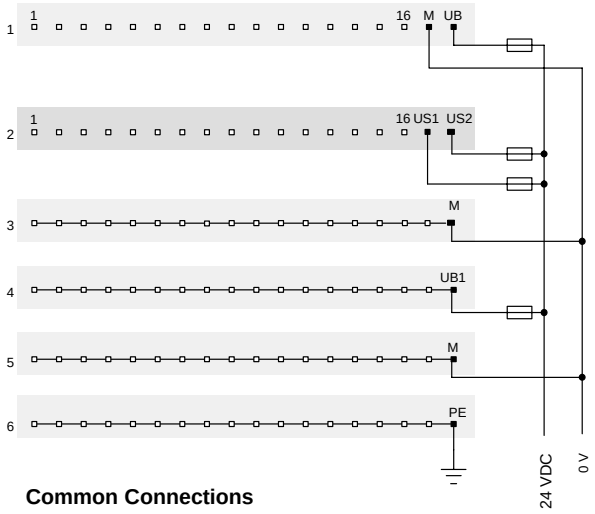
LED area

Mounting slots for terminal strip connectors

Mounting slot for bus bar connector

Field Wiring Connections

Connecting Operating Voltages



Common Connections

Row 3: Terminals 1 ... 18 (M) are connected together within the module.

External Bus Bar Connections

Row 4, 5, and 6: Install an external 3-row bus bar at row 4, and use the bus bar terminals for UB1, M, and PE field wiring.

Use row 4 for UB1 wiring connections.
Use row 5 for M wiring connections.
Use row 6 for PE wiring connections.

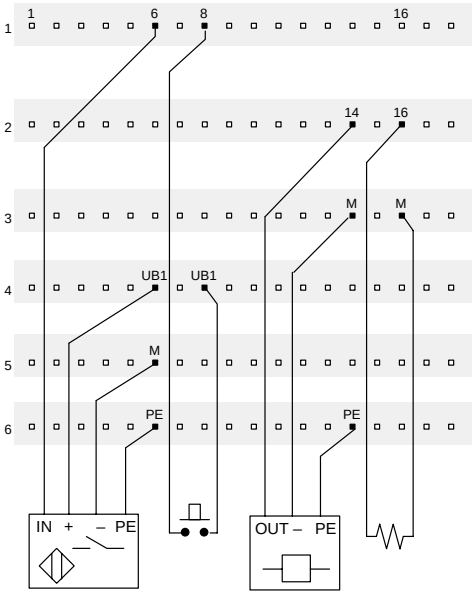
Terminals 1 ... 18 are connected together within each bus bar. There are no internal connections to the module.

External Fuses

UB supply: 200 mA fast blow.

UB1, US1 and US2 supply: Select a fuse that meets the total supply requirement of the connected devices. The maximum allowable fuse rating is: 6.3 A fast blow.

Connecting Field Devices

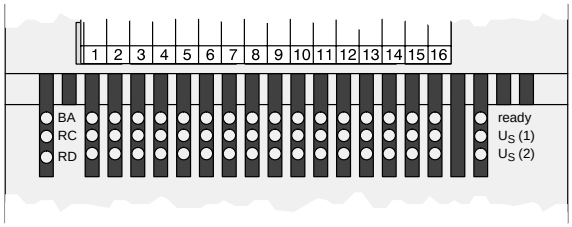


Labeling of Terminals

Row	Terminal	Connection	
1	1 ... 16	I1 ... I16	Input points 1 ... 16
1	17	M	Module operating voltage return
1	18	UB	Module operating voltage
2	1 ... 8	O1 ... O8	Output points 1 ... 8 (group 1)
2	9 ... 16	O9 ... O16	Output points 9 ... 16 (group 2)
2	17	US1	Voltage for outputs 1 ... 8 (group 1)
2	18	US2	Voltage for outputs 9 ... 16 (group 2)
3	18	M	Voltage return for field devices
4	18	UB1	Voltage for inputs 1 ... 16
5	18	M	Voltage return for field devices
6	18	PE	Earth ground for field devices

LED Indicators

LED Indicators



LED	Status	Meaning
ready	green	The module is ready to communicate on the network.
	off	The module is not ready. Check the UB voltage source.
BA	green	Bus Active. The module is transmitting data messages on the network.
	off	The module is not transmitting data messages on the network.
RC	green	Remote Bus Check. The module's incoming bus is connected correctly, and the bus master device is not sending a bus reset signal.
	off	The incoming bus is not connected correctly, or the bus master device is sending a bus reset signal.
RD	red	Remote Bus Disabled. The module's outgoing bus is disabled.
	off	The module's outgoing bus is enabled.
Us(1)	green	US1 voltage is present.
	off	US1 voltage is not present. Check the US1 source.
Us(2)	green	US2 voltage is present.
	off	US2 voltage is not present. Check the US2 source.
1 ... 16 upper row	green	Input 1 ... 16 is active (input voltage high level).
	off	Input 1 ... 16 is not active (input voltage low level).
1 ... 16 center row	green	Output 1 ... 16 is active (output voltage high level).
	off	Output 1 ... 16 is not active (output voltage low level).
1 ... 16 lower row	red	Output 1 ... 16 has an error condition (overload or short circuit).
	off	Output 1 ... 16 is operating normally.

Specifications

The module's **DC Input 24 Vdc 1x16 Sink** inputs accept 24 V dc inputs for use with source output devices. The **DC Output 24 Vdc 2x8 Source** outputs switch 24 V dc for use with sink input devices.

Specifications (General)

InterBus-S ID Code	0103 hexadecimal
Module Quiescent Current	100 mA @ 20 ... 30 Vdc
Module Protection	
Input Protection	Resistor limited
Output Protection	Electronically protected
Isolation (Input and Output)	
Group to Group	None
Group to Bus	500 Vac rms for 1 minute
Fault Detection	
Input	None
Output	Red LED indicator for each output – overcurrent and short circuit
Fusing	
Input	I**nternal –** None **External –** User discretion
Output	**Internal –** None, electronically protected **External –** User discretion

Specifications (Inputs)

Number of Input Points	16 in one group
Operating Voltages and Currents	
Guaranteed ON (voltage)	+15 ... +30 Vdc
Guaranteed OFF (voltage)	–3 ... +5 Vdc
Guaranteed ON (current)	2.4 mA
Guaranteed OFF (current)	0.9 mA
Absolute Maximum Input	
Continuous	30 Vdc
1.3 ms	56 Vdc decaying pulse
Internal Resistance (Input)	5.6 k
Response (Input)	
OFF – ON	3 ms max
ON – OFF	3 ms max

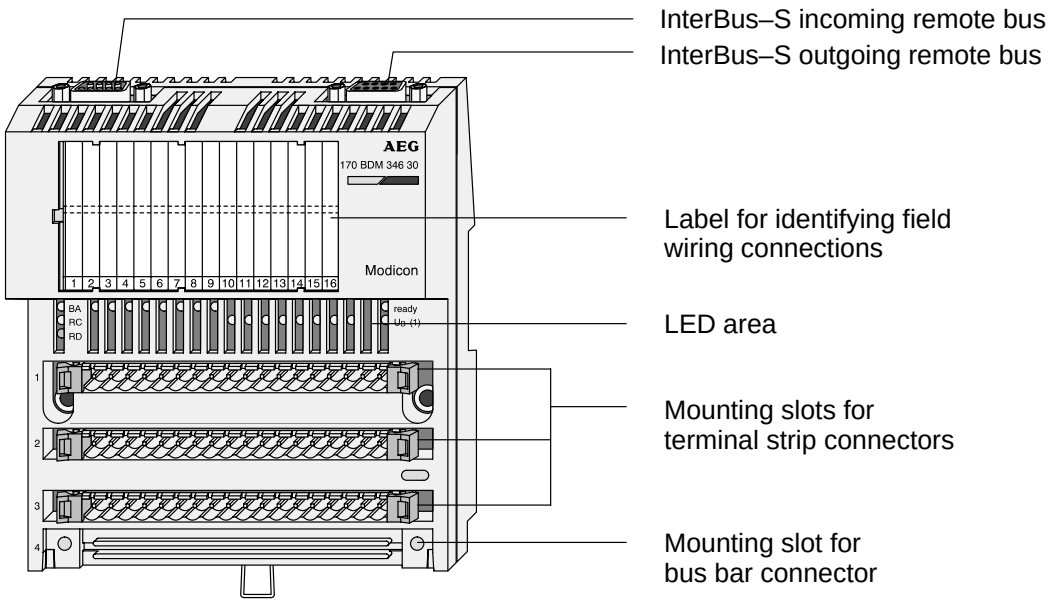
Specifications (Outputs)

Number of Output Points	16 in two 8 point groups
Voltage (Output)	
Operating (max)	19.2 ... 30 Vdc
Absolute (max)	56 Vdc for 1.3 ms decaying voltage pulse
ON State Drop / Point	0.5 Vdc @ 0.5 A
Maximum Load Current	
Each Point	0.5 A
Each Group	4 A
Per Module	8 A
Off State Leakage / Point	0.4 mA @ 30 Vdc
Maximum Surge Current	
Each Point	5 A @ 500 µs duration (no more than 6 per minute)
Maximum Loading	
Each Point	12 W @ 100 cycles/s, resistive 12 W @ 1000 cycles/h, inductive 1.2 W @ 8 cycles/s, lamp
Load Capacitance Maximum	50 µf
Response (Output)	
OFF – ON	1 ms max (resistive load)
ON – OFF	1 ms max (resistive load)

170 BDM 346 30
InterBus–S TIO
24 VDC 8 Input / 24 ... 230 VAC/DC 8 Relay Output Module

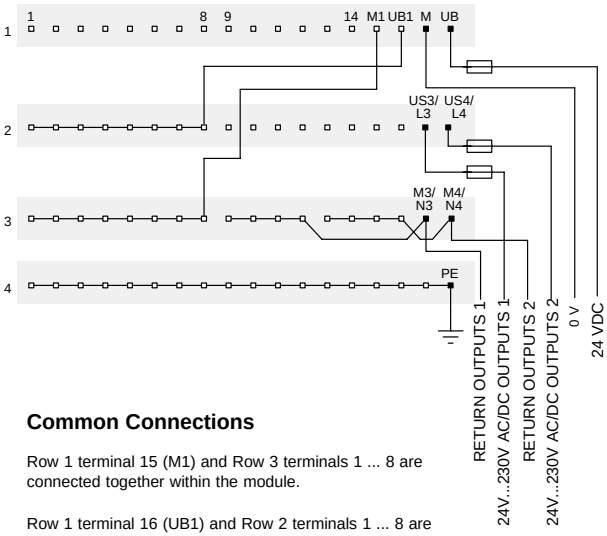
Module Type	8 discrete input points, in 1 group 8 relay output points, in 2 groups of 4 points
Nominal Operating Voltage	24 V dc
Nominal Input Current, each point	4.2 mA at 24 V dc
Maximum Output Current, each point	2.0 A at 24 ... 230 V ac/dc

Front View

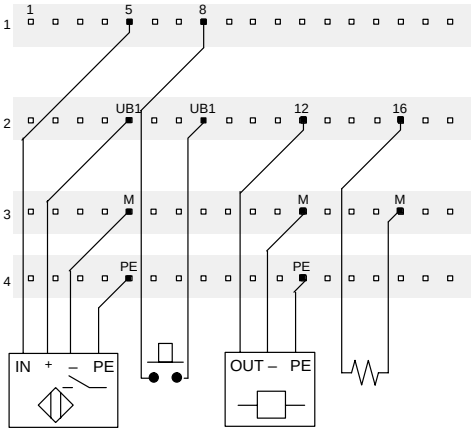


Field Wiring Connections

Connecting Operating Voltages



Connecting Field Devices



Common Connections

Row 1 terminal 15 (M1) and Row 3 terminals 1 ... 8 are connected together within the module.

Row 1 terminal 16 (UB1) and Row 2 terminals 1 ... 8 are connected together within the module.

Row 3: Terminals 9 ... 12 and 17 (M3/N3) are connected together within the module.

Row 3: Terminals 13 ... 16 and 18 (M4/N4) are connected together within the module.

Row 4: Install an external bus bar at row 4. Terminals 1 ... 18 (PE) are connected together within the external bus bar. There is no connection to the module.

External Fuses

UB supply: 200 mA fast blow.

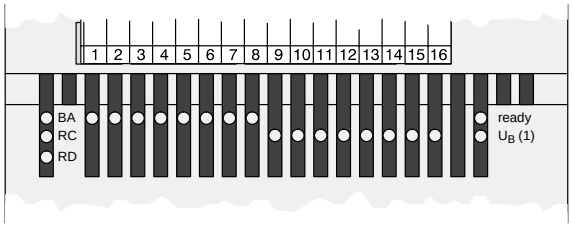
US3/L3, US4/L4 supplies: Select a fuse that meets the total supply requirement of the connected devices. The maximum allowable fuse rating is: 8 A fast blow.

Labeling of Terminals

Row	Terminal	Connection	
1	1 ... 8	I1 ... I8	Input points 1 ... 8
1	15	M1	Voltage return for input devices
1	16	UB1	Voltage for input devices
1	17	M	Module operating voltage return
1	18	UB	Module operating voltage
2	1 ... 8	UB1	Voltage for input devices
2	9 ... 12	O1 ... O4	Relay output points 1 ... 4
2	13 ... 16	O5 ... O8	Relay output points 5 ... 8
2	17	US3/L3	DC/AC voltage for relay outputs 1 ... 4
2	18	US4/L4	DC/AC voltage for relay outputs 5 ... 8
3	1 ... 8	M1	Voltage return for input devices
3	17	M3/L3	DC/AC voltage return for outputs 1 ... 4
3	18	M4/L4	DC/AC voltage return for outputs 5 ... 8
4	18	PE	Earth ground for field devices

LED Indicators

LED Indicators



LED	Status	Meaning
ready	green	The module is ready to communicate on the network.
	off	The module is not ready. Check the UB voltage source.
BA	green	Bus Active. The module is transmitting data messages on the network.
	off	The module is not transmitting data messages on the network.
RC	green	Remote Bus Check. The module's incoming bus is connected correctly, and the bus master device is not sending a bus reset signal.
	off	The incoming bus is not connected correctly, or the bus master device is sending a bus reset signal.
RD	red	Remote Bus Disabled. The module's outgoing bus is disabled.
	off	The module's outgoing bus is enabled.
U_B(1)	green	UB1 voltage is present.
	off	UB1 voltage is not present. Check the UB1 source.
1 ... 8 upper row	green	Input 1 ... 18 is active (input voltage high level).
	off	Input 1 ... 18 is not active (input voltage low level).
9 ... 16 lower row	green	Output 9 ... 16 is active (output voltage high level).
	off	Output 9 ... 16 is not active (output voltage low level).

Specifications

The **DC Input 24 Vdc Sink 1x8** / **Relay Output Normally Open 2x4** module provides 24 Vdc sink inputs for use with source output devices, and provides normally-open Relay contacts for devices with up to 2.0 A loads.

Specifications (General)

InterBus-S ID Code	0103 hexadecimal
Module Quiescent Current	100 mA @ 20 ... 30 Vdc
Fusing	
Internal	None
External	User discretion
Fault Detection	None

Specifications (Inputs)

Number of Input Points	8 in one group
Operating Voltages and Currents	
Guaranteed ON (voltage)	+15 ... +30 Vdc
Guaranteed OFF (voltage)	–3 ... +5 Vdc
Guaranteed ON (current)	2.4 mA
Guaranteed OFF (current)	0.9 mA
Absolute Maximum Input	
Continuous	30 Vdc
1.3 ms	56 Vdc decaying pulse
Response	
OFF – ON	3 ms (max)
ON – OFF	3 ms (max)
Internal Resistance	5.6 k
Input Protection	Resistor limited
Isolation	
Group to Group	50 Vdc
Group to Bus	500 Vdc

Specifications (Outputs)

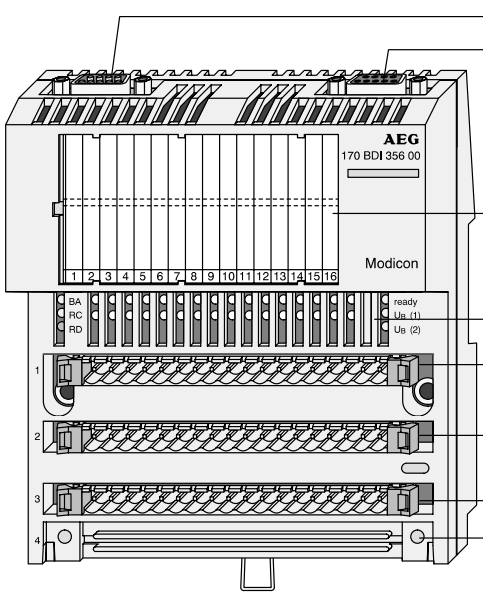
Number of Output Points	8 normally open relay contacts
Voltage	
Working	20 ... 250 Vac 5 ... 30 Vdc
Maximum Load Current	
Each Point	2 A max, at 250 Vac or 30 Vdc @ 60°C ambient resistive load
	1 A Tungsten lamp load
	1 A @ a power factor of 0.4
	1/8 hp @ 125/250 Vac
Minimum Load Current	100 mA
Response	
OFF – ON	10 ms max
ON – OFF	20 ms max

Relay Contact Life	
Mechanical Operations	10,000,000
Electrical Operations	200,000 (Resistive load @ max voltage and current)
Relay Type	Form A
Contact Protection	None
Isolation	
Channel to Channel	1780 Vac rms for one minute
Field to Bus	1780 Vac rms for one minute 2500 Vdc for one minute

170 BDI 356 00
Interbus–S TIO
24 VDC 32 Input Module

Module Type	32 discrete input points
Nominal Input Voltage	24 V dc
Nominal Input Current, each point	4.2 mA

Front View



InterBus–S incoming remote bus

InterBus–S outgoing remote bus

Label for identifying field wiring connections

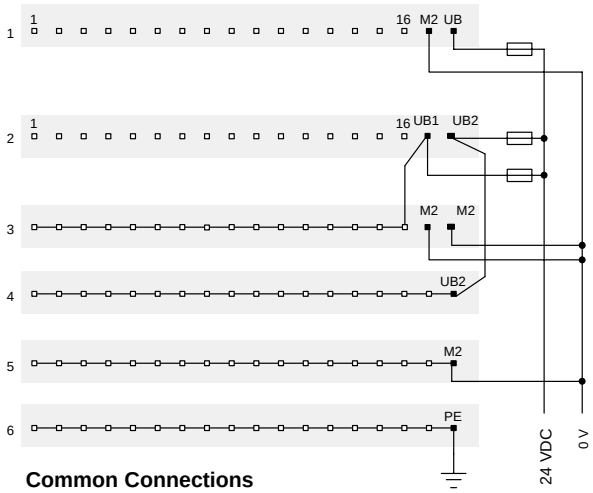
LED area

Mounting slots for terminal strip connectors

Mounting slot for bus bar connector

Field Wiring Connections

Connecting Operating Voltages



Common Connections

Row 2 and 3: Row 2 terminal 17 (UB1) is connected internally to Row 3 Terminals 1 ... 16 (UB1) within the module.

External Bus Bar Connections

Row 4, 5, and 6: Install an external 3-row bus bar at row 4, and use the bus bar terminals for UB2, M2, and PE field wiring. Terminals 1 ... 18 are connected together within each bus bar. There are no internal connections to the module.

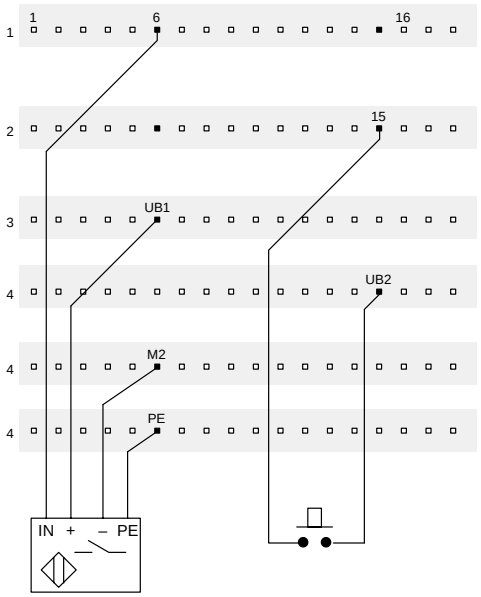
Use row 4 for UB2 wiring connections.
Use row 5 for M2 wiring connections.
Use row 6 for PE wiring connections.

External Fuses

UB supply: 200 mA fast blow.

UB1 and UB2 supply: Select a fuse that meets the total supply requirement of the connected devices. The maximum allowable fuse rating is: 4 A fast blow.

Connecting Field Devices

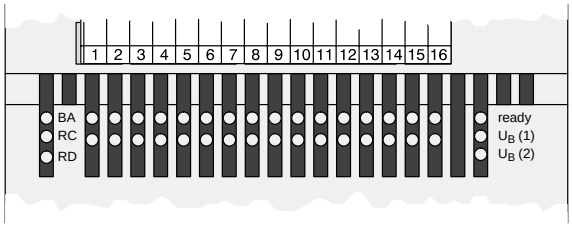


Labeling of Terminals

Row	Terminal	Connection	
1	1 ... 16	I1 ... I16	Input points 1 ... 16
1	17	M2	Module and devices voltage return
1	18	UB	Module operating voltage
2	1 ... 16	I17 ... I32	Input points 17 ... 32
2	17	UB1	Voltage for devices 1 ... 16
2	18	UB2	Voltage for devices 17 ... 32
3	17, 18	M2	Module and devices voltage return
4	1 ... 18	UB2	External bus bar — UB2 wiring
5	1 ... 18	M2	External bus bar — M2 wiring
6	1 ... 18	PE	External bus bar — Earth ground

LED Indicators

LED Indicators



LED	Status	Meaning
ready	green	The module is ready to communicate on the network.
	off	The module is not ready. Check the UB voltage source.
BA	green	Bus Active. The module is transmitting data messages on the network.
	off	The module is not transmitting data messages on the network.
RC	green	Remote Bus Check. The module's incoming bus is connected correctly, and the bus master device is not sending a bus reset signal.
	off	The incoming bus is not connected correctly, or the bus master device is sending a bus reset signal.
RD	red	Remote Bus Disabled. The module's outgoing bus is disabled.
	off	The module's outgoing bus is enabled.
UB(1)	green	UB1 voltage is present.
	off	UB1 voltage is not present. Check the UB1 source.
UB(2)	green	UB2 voltage is present.
	off	UB2 voltage is not present. Check the UB2 source.
1 ... 16	green	Input 1 ... 16 is active (input voltage high level).
Upper row	off	Input 1 ... 16 is not active (input voltage low level).
1 ... 16	green	Input 17 ... 32 is active (input voltage high level).
Lower row	off	Input 17 ... 32 is not active (input voltage low level).

Specifications

The **DC Input 24 Vdc 32-point** Sink module accepts 24 Vdc inputs and is for use with source output devices.

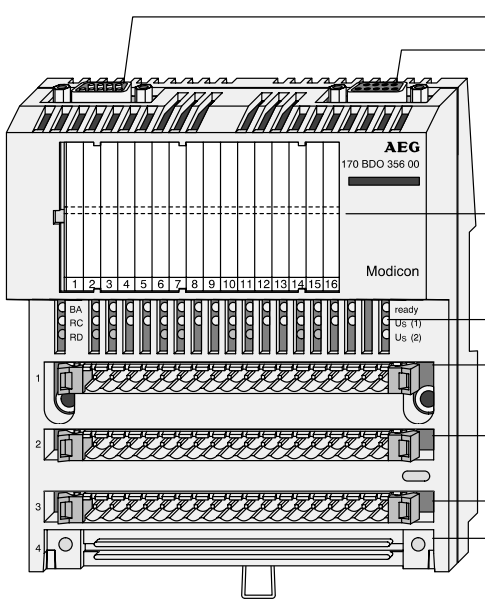
Specifications

InterBus-S ID Code	0202 hexadecimal
Number of Input Points	32
Module Quiescent Current	100 mA @ 20 ... 30 Vdc
Operating Voltages and Currents	
Guaranteed ON (voltage)	+15 ... +30 Vdc
Guaranteed OFF (voltage)	–3 ... +5 Vdc
Guaranteed ON (current)	2.4 mA
Guaranteed OFF (current)	0.9 mA
Absolute Maximum Input	
Continuous	30 Vdc
1.3 ms	56 Vdc decaying pulse
Response	
OFF – ON	3 ms (max)
ON – OFF	3 ms (max)
Internal Resistance	5.6 k
Input Protection	Resistor limited
Isolation	
Group to Group	None
Group to Bus	500 Vac rms for 1 minute
Fault Detection	None
Fusing	
Internal	None
External	User discretion, 4A max

170 BDO 356 00
InterBus–S TIO
24 VDC 32 Output Module

Module Type	32 discrete output points, in 2 groups of 16 points
Nominal Output Voltage	24 V dc
Nominal Output Current, each point	0.5 A

Front View



InterBus–S incoming remote bus

InterBus–S outgoing remote bus

Label for identifying field wiring connections

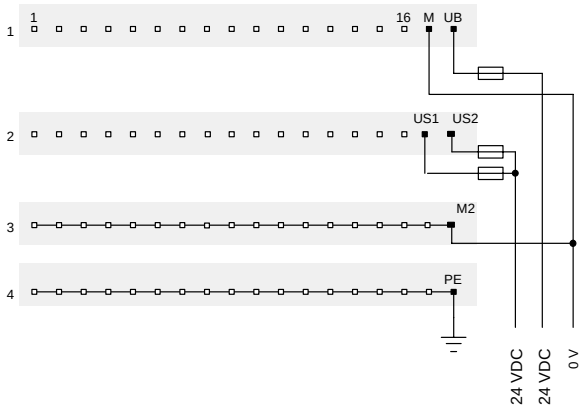
LED area

Mounting slots for terminal strip connectors

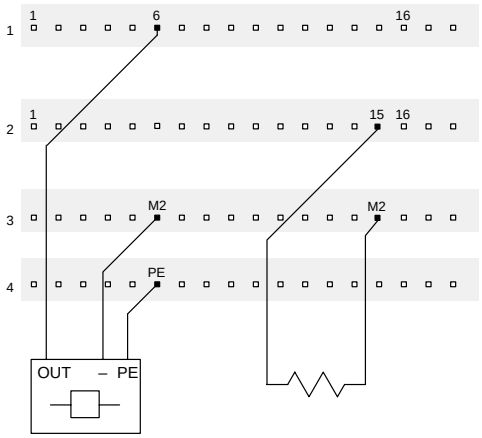
Mounting slot for bus bar connector

Field Wiring Connections

Connecting Operating Voltages



Connecting Field Devices



Common Connections

Row 3: Terminals 1 ... 18 (M2) are connected together within the module.

Row 4: Install an external bus bar at row 4. Terminals 1 ... 18 (PE) are connected together within the external bus bar. There is no connection to the module.

External Fuses

UB supply: 200 mA fast blow.

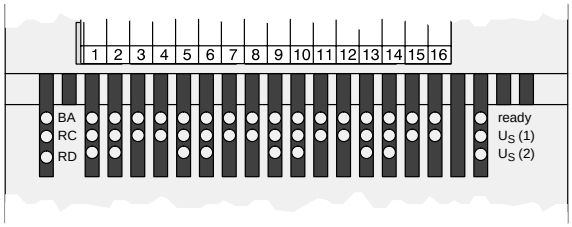
US1 and US2 supply: Select a fuse that meets the total supply requirement of the connected devices. The maximum allowable fuse rating is: 4 A fast blow.

Labeling of Terminals

Row	Terminal	Connection	
1	1 ... 16	O1 ... O16	Output points 1 ... 16 (group 1)
1	17	M	Module operating voltage return
1	18	UB	Module operating voltage
2	1 ... 16	O17 ... O32	Output points 17 ... 32 (group 2)
2	17	US1	Voltage for devices 1 ... 16 (group 1)
2	18	US2	Voltage for devices 17 ... 32 (group 2)
3	18	M2	Voltage return, devices 1 ... 32
4	18	PE	Earth ground for field devices

LED Indicators

LED Indicators



LED	Status	Meaning
ready	green	The module is ready to communicate on the network.
	off	The module is not ready. Check the UB voltage source.
BA	green	Bus Active. The module is transmitting data messages on the network.
	off	The module is not transmitting data messages on the network.
RC	green	Remote Bus Check. The module's incoming bus is connected correctly, and the bus master device is not sending a bus reset signal.
	off	The incoming bus is not connected correctly, or the bus master device is sending a bus reset signal.
RD	red	Remote Bus Disabled. The module's outgoing bus is disabled.
	off	The module's outgoing bus is enabled.
US(1)	green	US1 voltage is present.
	off	US1 voltage is not present. Check the US1 source.
US(2)	green	US2 voltage is present.
	off	US2 voltage is not present. Check the US2 source.
1 ... 16 upper row	green	Terminal Row 1 Output 1 ... 16 is active (output voltage high level).
	off	Terminal Row 1 Output 1 ... 16 is not active (output voltage low level).
1 ... 16 center row	green	Terminal Row 2 Output 1 ... 16 is active (output voltage high level).
	off	Terminal Row 2 Output 1 ... 16 is not active (output voltage low level).
1, 5, 9 13 lower row	red	Error condition (overload or short circuit) in Terminal Row 1 Output Group: 1: Outputs 1 ... 4; 5: Outputs 5 ... 8; 9: Outputs 9 ... 12; 13: Outputs 13 ... 16.
	off	Terminal Row 1 Output Group is operating normally.
2, 6, 10 14 lower row	red	Error condition (overload or short circuit) in Terminal Row 2 Output Group: 1: Outputs 1 ... 4; 5: Outputs 5 ... 8; 9: Outputs 9 ... 12; 13: Outputs 13 ... 16.
	off	Terminal Row 2 Output Group is operating normally.

Specifications

The **DC Output 24 Vdc 2x16 Source** module switches 24 Vdc powered loads and is for use with sink devices.

Specifications

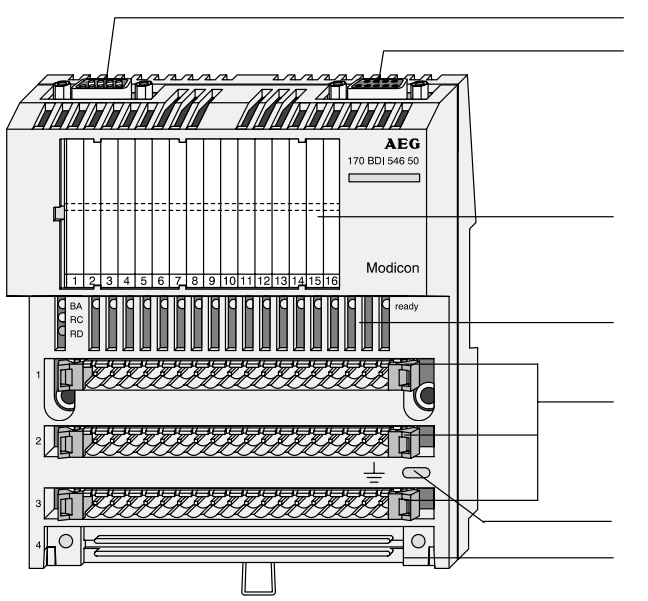
InterBus-S ID Code	0201 hexadecimal
Number of Output Points	32 in two 16 point groups
Module Quiescent Current	100 mA @ 20 ... 30 Vdc
Output Voltage	
Operating (max)	19.2 ... 30 Vdc
Absolute (max)	56 Vdc for 1.3 ms decaying voltage pulse
ON State Drop / Point	0.4 Vdc @ 0.5 A
Maximum Load Current	
Each Point	0.5 A
Each Group	8 A
Per Module	16 A
Off State Leakage / Point	0.4 mA @ 30 Vdc
Surge Current Maximum	
Each Point	5 A @ 500 µs duration (no more than 6 per minute)
Response (Resistive Loads)	
OFF – ON	1 ms (max)
ON – OFF	1 ms (max)
Output Protection (internal)	Transient voltage suppression
Maximum Loading	
Each Point	12 W @ 100 cycles/s, resistive 12 W @ 1000 cycles/h, inductive 1.2 W @ 8 cycles/s, lamp
Load Capacitance Maximum	50 uf
Isolation	
Group to Group	30 V
Output to Bus	500 V
Fault Detection	Red LED indicator for each output

Fusing	
Internal	None
External	User discretion

170 BDI 546 50
InterBus–S TIO
115 VAC 16 Input Module

Module Type	16 discrete input points, in 2 groups of 8 points
Nominal Input Voltage	115 V ac
Nominal Input Current, each point	10 mA

Front View



Interbus–S incoming remote bus

Interbus–S outgoing remote bus

Label for identifying field wiring connections

LED area

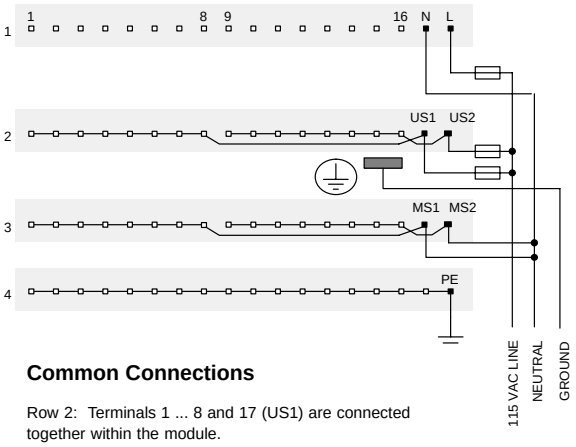
Mounting slots for terminal strip connectors

Lug for ground wire

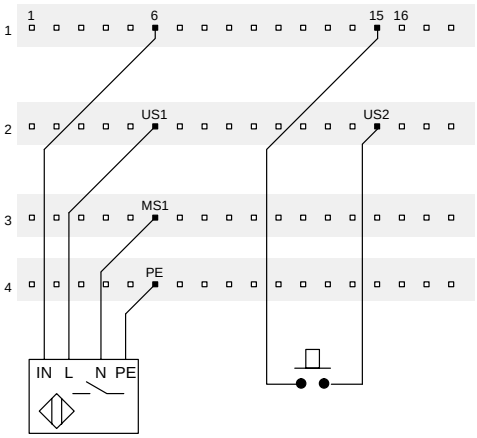
Mounting slot for bus bar connector

Field Wiring Connections

Connecting Operating Voltages



Connecting Field Devices



Common Connections

Row 2: Terminals 1 ... 8 and 17 (US1) are connected together within the module.

Row 2: Terminals 9 ... 16 and 18 (US2) are connected together within the module.

Row 3: Terminals 1 ... 8 and 17 (MS1) are connected together within the module.

Row 3: Terminals 9 ... 16 and 18 (MS2) are connected together within the module.

Row 4: Install an external bus bar at row 4. Terminals 1 ... 18 (PE) are connected together within the external bus bar. There is no connection to the module.

External Fuses

L supply: 100 mA fast blow.

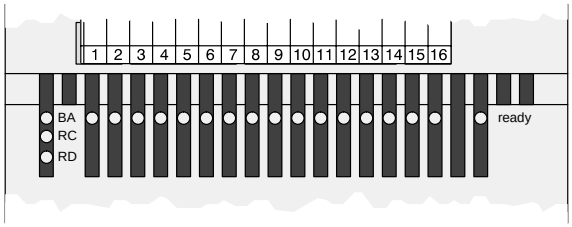
US1 and US2 supply: Select a fuse that meets the total supply requirement of the connected devices. The maximum allowable fuse rating is: 4 A fast blow.

Labeling of Terminals

Row	Terminal	Connection	
1	1 ... 8	I1 ... I8	Input points 1 ... 8 (group 1)
1	9 ... 16	I9 ... I16	Input points 9 ... 16 (group 2)
1	17	N	Module operating voltage, Neutral
1	18	L	Module operating voltage, Line
2	17	US1	Voltage for devices 1 ... 8 (group 1)
2	18	US2	Voltage for devices 9 ... 16 (group 2)
3	17	MS1	Voltage return for 1 ... 8 (group 1)
3	18	MS2	Voltage return for 9 ... 16 (group 2)
4	18	PE	Earth ground for field devices
	⏚		Power ground

LED Indicators

LED Indicators



LED	Status	Meaning
ready	green	The module is ready to communicate on the network.
	off	The module is not ready. Check the UB voltage source.
BA	green	Bus Active. The module is transmitting data messages on the network.
	off	The module is not transmitting data messages on the network.
RC	green	Remote Bus Check. The module's incoming bus is connected correctly, and the bus master device is not sending a bus reset signal.
	off	The incoming bus is not connected correctly, or the bus master device is sending a bus reset signal.
RD	red	Remote Bus Disabled. The module's outgoing bus is disabled.
	off	The module's outgoing bus is enabled.
1 ... 16	green	Input 1 ... 16 is active (input voltage high level).
	off	Input 1 ... 16 is not active (input voltage low level).

Specifications

The **AC Input 115 Vac 2x8** module accepts 115 Vac inputs.

Specifications

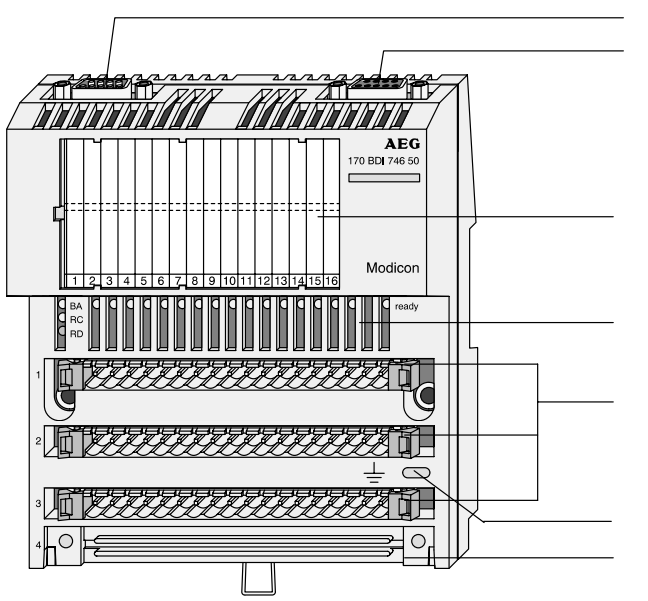
InterBus-S ID Code	0102 hexadecimal
Number of Input Points	16 in two 8 point groups
Module Quiescent Current	40 mA @ 85 ... 264.5 Vac
Input Voltage and Currents Ranges	
Voltage	Guaranteed ON: 74 Vac Guaranteed OFF: 20 Vac
Current	Guaranteed ON: 10 mA Guaranteed OFF: 2 mA
Input Frequency	47 ... 63 Hz
Absolute Maximum Input	
Continuous	132 Vac
10 s	156 Vac
1 cycle	200 Vac
1.3 ms	276 Vac
Response	
OFF – ON	Min: 4.9 ms Max: 0.75 line cycle
ON – OFF	Min: 7.3 ms Max: 12.3 ms
Isolation	
Input to Input	All inputs in a group must be from the same phase of line input voltage
Group to Group	1780 Vac rms for 1 minute
Input to Bus	1780 Vac rms for 1 minute
Fault Detection	None
Fusing	
Internal	None
External	User discretion

☞ **Note:** Input signals must be sinusoidal with less than 6% THD.

170 BDI 746 50
InterBus–S TIO
230 VAC 16 Input Module

Module Type	16 discrete input points, in 2 groups of 8 points
Nominal Input Voltage	230 V ac
Nominal Input Current, each point	6 mA

Front View



Interbus–S incoming remote bus

Interbus–S outgoing remote bus

Label for identifying field wiring connections

LED area

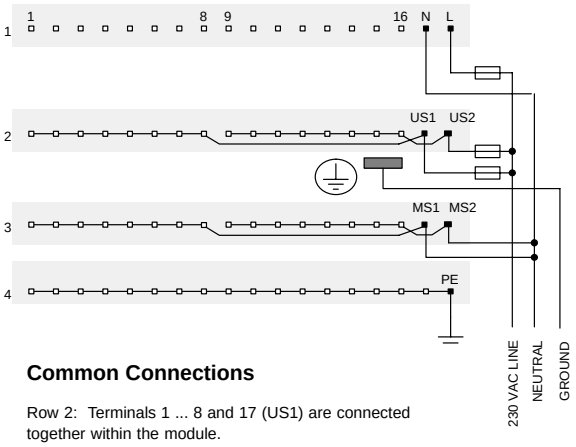
Mounting slots for terminal strip connectors

Lug for ground wire

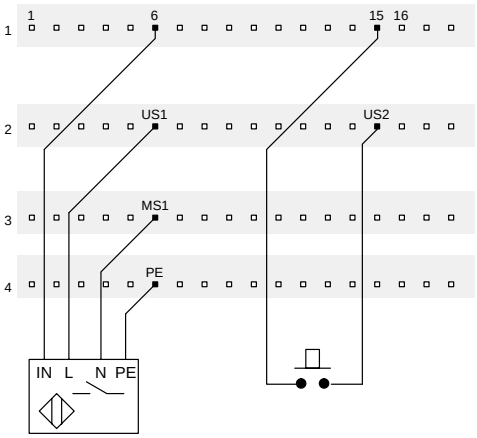
Mounting slot for bus bar connector

Field Wiring Connections

Connecting Operating Voltages



Connecting Field Devices



Common Connections

Row 2: Terminals 1 ... 8 and 17 (US1) are connected together within the module.

Row 2: Terminals 9 ... 16 and 18 (US2) are connected together within the module.

Row 3: Terminals 1 ... 8 and 17 (MS1) are connected together within the module.

Row 3: Terminals 9 ... 16 and 18 (MS2) are connected together within the module.

Row 4: Install an external bus bar at row 4. Terminals 1 ... 18 (PE) are connected together within the external bus bar. There is no connection to the module.

External Fuses

L supply: 100 mA fast blow.

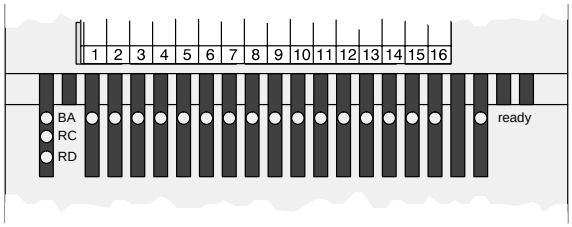
US1 and US2 supply: Select a fuse that meets the total supply requirement of the connected devices. The maximum allowable fuse rating is: 4 A fast blow.

Labeling of Terminals

Row	Terminal	Connection	
1	1 ... 8	I1 ... I8	Input points 1 ... 8 (group 1)
1	9 ... 16	I9 ... I16	Input points 9 ... 16 (group 2)
1	17	N	Module operating voltage, Neutral
1	18	L	Module operating voltage, Line
2	17	US1	Voltage for devices 1 ... 8 (group 1)
2	18	US2	Voltage for devices 9 ... 16 (group 2)
3	17	MS1	Voltage return for 1 ... 8 (group 1)
3	18	MS2	Voltage return for 9 ... 16 (group 2)
4	18	PE	Earth ground for field devices
	⏚		Power ground

LED Indicators

LED Indicators



LED	Status	Meaning
ready	green	The module is ready to communicate on the network.
	off	The module is not ready. Check the UB voltage source.
BA	green	Bus Active. The module is transmitting data messages on the network.
	off	The module is not transmitting data messages on the network.
RC	green	Remote Bus Check. The module's incoming bus is connected correctly, and the bus master device is not sending a bus reset signal.
	off	The incoming bus is not connected correctly, or the bus master device is sending a bus reset signal.
RD	red	Remote Bus Disabled. The module's outgoing bus is disabled.
	off	The module's outgoing bus is enabled.
1 ... 16	green	Input 1 ... 16 is active (input voltage high level).
	off	Input 1 ... 16 is not active (input voltage low level).

Specifications

The **AC Input 230 Vac 2x8** module accepts 230 Vac inputs.

Specifications

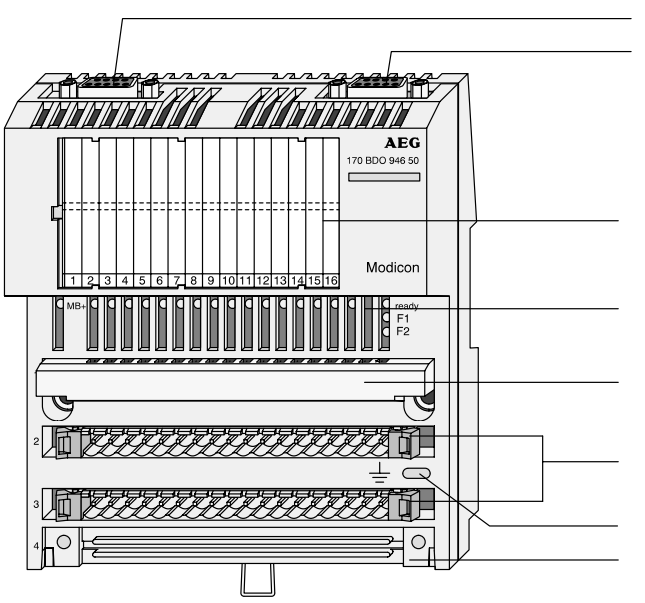
InterBus-S ID Code	0102 hexadecimal
Number of Input Points	16 in two 8 point groups
Module Quiescent Current	25 mA @ 170 ... 264.5 Vac
Input Voltage and Currents Ranges	
Voltage	Guaranteed ON: 170 Vac Guaranteed OFF: 40 Vac
Current	Guaranteed ON: 3 mA Guaranteed OFF: 2 mA
Input Frequency	47 ... 63 Hz
Absolute Maximum Input	
Continuous	264 Vac
10 s	300 Vac
1 cycle	400 Vac
Response	
OFF – ON	Max: 0.75 line cycle
ON – OFF	Max: 1 line cycle
Isolation	
Input to Input	1780 Vac rms for 1 minute
Group to Group	1780 Vac rms for 1 minute
Input to Bus	1780 Vac rms for 1 minute
Fault Detection	None
Fusing	
Internal	None
External	User discretion

☞ **Note:** Input signals must be sinusoidal with less than 6% THD.

170 BDO 946 50
InterBus–S TIO
115 ... 230 VAC 16 Output Module

Module Type	16 discrete output points, in 2 groups of 8 points
Nominal Output Voltage	115 ... 230 V ac
Maximum Output Current, each point	0.5 A rms

Front View



Interbus–S incoming remote bus

Interbus–S outgoing remote bus

Label for identifying field wiring connections

LED area

Protective cover (Fuses located inside)

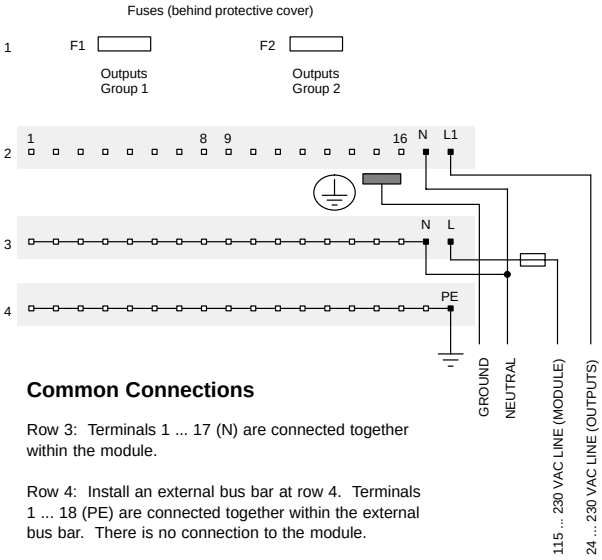
Mounting slots for terminal strip connectors

Lug for ground wire

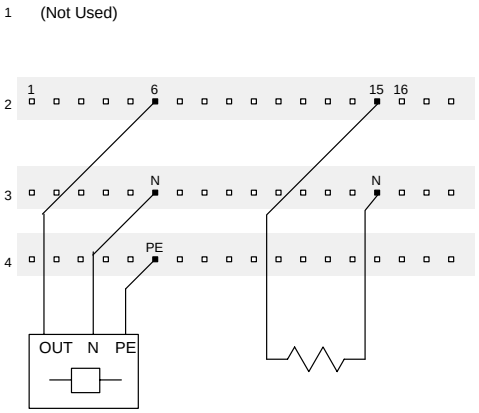
Mounting slot for bus bar connector

Field Wiring Connections

Connecting Operating Voltages



Connecting Field Devices



Common Connections

Row 3: Terminals 1 ... 17 (N) are connected together within the module.

Row 4: Install an external bus bar at row 4. Terminals 1 ... 18 (PE) are connected together within the external bus bar. There is no connection to the module.

Internal Fuses

L1 supply: 8 A 250 V fast blow, for each output group.
Total fuses: 2.

External Fuse

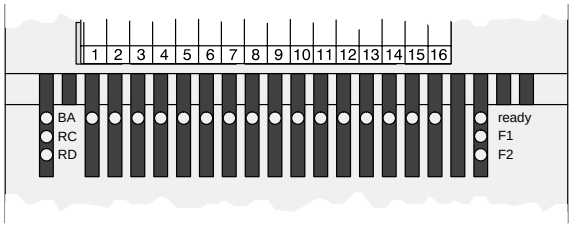
L supply: 100 mA 250 V fast blow.

Labeling of Terminals

Row	Terminal	Connection	
2	1 ... 8	O1 ... O8	Output points 1 ... 8 (group 1)
2	9 ... 16	O9 ... O16	Output points 9 ... 16 (group 2)
2	17	N	Voltage for field devices, Neutral
2	18	L1	Voltage for field devices, Line
3	17	N	Module operating voltage, Neutral
3	18	L	Module operating voltage, Line
4	18	PE	Earth ground for field devices
	⏚		Power ground

LED Indicators

LED Indicators



LED	Status	Meaning
ready	green	The module is ready to communicate on the network.
	off	The module is not ready. Check the UB voltage source.
F1	green	Fuse F1 (group 1 outputs) is OK.
	off	Fuse F1 is not OK.
F2	green	Fuse F2 (group 2 outputs) is OK.
	off	Fuse F2 is not OK.
BA	green	Bus Active. The module is transmitting data messages on the network.
	off	The module is not transmitting data messages on the network.
RC	green	Remote Bus Check. The module's incoming bus is connected correctly, and the bus master device is not sending a bus reset signal.
	off	The incoming bus is not connected correctly, or the bus master device is sending a bus reset signal.
RD	red	Remote Bus Disabled. The module's outgoing bus is disabled.
	off	The module's outgoing bus is enabled.
1 ... 16	green	Output 1 ... 16 is active (output voltage high level).
	off	Output 1 ... 16 is not active (output voltage low level).

Specifications

The **AC Output 115 ... 230 Vac 2x8** module switches 115 ... 230 Vac powered loads.

Specifications

InterBus-S ID Code	0101 hexadecimal
Number of Output Points	16 in two 8 point groups
Module Quiescent Current	40 mA @ 85 ... 264.5 Vac
Output Voltage (rms)	
Working	74 ... 253 Vac
Absolute Maximum	300 Vac for 10 s 400 Vac for 1 cycle
Frequency	47 ... 63 Hz
ON State Drop / Point	1.5 Vac max
Minimum Load Current (rms)	10 mA
Maximum Load Current (rms)	
Each Point	0.5 A continuous, 74 ... 132 Vac rms, 0.5 A continuous, 170 ... 253 Vac rms
Any Four Contiguous Points	2 A max continuous for the sum of the four points
Per Module	8 A continuous
Off State Leakage / Point (max)	3.75 mA

Surge Current Maximum (rms)	**Per Point**
One Cycle	15 A
Two Cycles	10 A
Three Cycles	5 A
Applied DV / DT	400 V/µs
Commutative DV / DT	5 V/µs
Response	
OFF – ON	0.50 of one line cycle max
ON – OFF	0.50 of one line cycle max
Output Protection (internal)	RC snubber suppression
Isolation (rms)	
Output to Output	300 Vac for 1 minute
Output to Bus	1780 for 1 minute
Fusing	
Internal	One 6.3 A 250 V fuse per group
External	User discretion

Appendix A
Modbus Plus TIO Registers

- Modbus Plus TIO Module Registers
- Write Privilege to Modules

A .1 Modbus Plus TIO Module Registers

Each Modbus Plus TIO module contains three groups of internal registers. These can be accessed through the network to transfer input or output data, to set or retrieve the module's configuration, or to monitor its status.

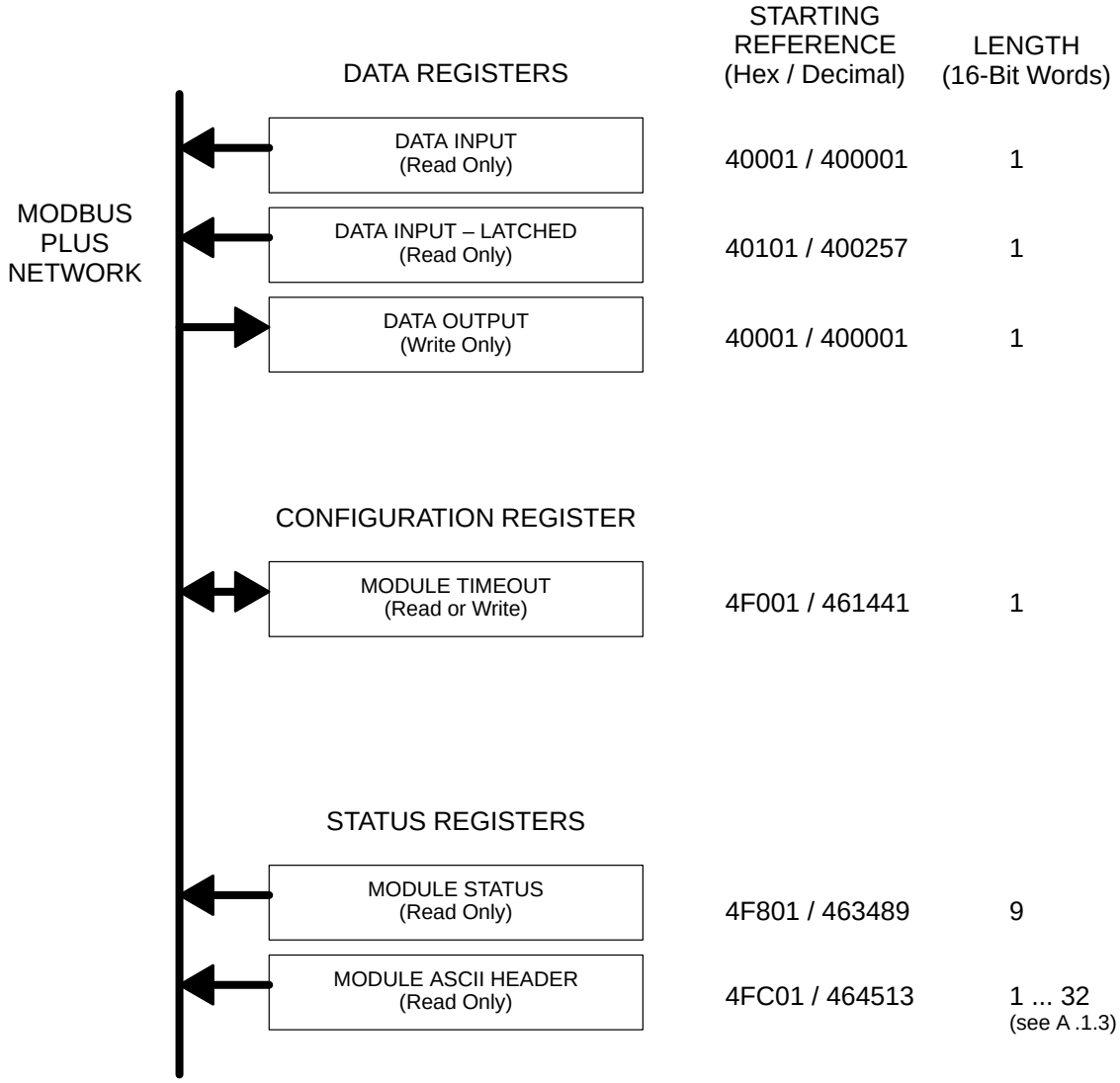


Figure 3 Modbus Plus TIO Module Registers Layout

A .1.1 Data Registers

These registers contain the input or output data for each module.

40001 hex –– Data Input or Output

Reference 40001 is used to address input data from field inputs, and output data to field outputs.

This reference is the only one that is accessible through Peer Cop data transfers. All other registers can be accessed using MSTR blocks.

40101 hex –– Data Input, Latched

Reference 40101 latches inputs ON for a minimum of 500 milliseconds, if an ON input occurs with a time duration less than this. It ensures that shorter input pulses are captured and made available to the TIO application. If an input remains ON for more than this duration, the reference does not continue to latch it, but follows the input's state.

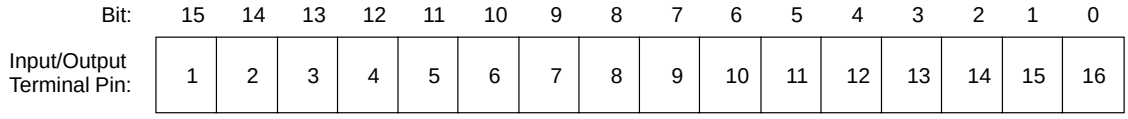


Figure 4 Input/Output Registers Bit Layout

Quantity of Data Bytes Transferred

Each TIO module transfers the following quantities of data bytes for a read or write operation.

Part Number	Module Type	Read (Bytes)	Write (Bytes)
170 BDI 342 00	Discrete 16 in 24 V dc	2	1
170 BDO 342 00	Discrete 16 out 24 V dc	1	2
170 BDM 342 00	Discrete 16 in/16 out 24 V dc	3	2
170 BDI 542 50	Discrete 16 in 115 V ac	2	1
170 BDO 542 50	Discrete 16 out 24 ... 230 V ac	1	2

A .1.2 Configuration Register

This register controls the holdup timeout value for output modules.

4F001 hex –– Outputs Holdup Time
Reference 4F001 specifies the amount of time that outputs will be held in their current state, if they are not updated by a new Modbus Plus Write command.

The timeout value is expressed in units of 10 milliseconds, with a minimum register value of 30 (300 milliseconds) and maximum value of 6000 (60 seconds). The default value is 100 (1 second).

If the module's holdup value expires before a new Write command is received, all outputs are set to logical 0 (zero).

The current contents of the register can be read using a Modbus Plus Read command.

A .1.3 Status Registers

4F801 ... 4F809 hex –– Status Block

These registers provide information about the module's revision level and current operating parameters. Nine words are used to contain the module's status.

Ref (hex)	Meaning	Contents
4F801	Length of status area	9
4F802	Quantity of module input bytes	2 for input module, 1 for output module
4F803	Quantity of module output bytes	1 for input module, 2 for output module
4F804	Reserved	
4F805	Module revision number	Format: XR where: X = upper 4 bits , reserved for station management commands (always 0). R = revision number. Example: 200 hex shows revision 2.00.
4F806	ASCII header block length, words	1 ... 32
4F807	Last node address to communicate with this module	1 ... 64
4F808	Remaining write reservation time, seconds	0 ... 60
4F809	Remaining outputs holdup time, units of 10 milliseconds	30 ... 6000

4FC01 ... 4FC20 hex –– ASCII Header Block

These registers contain a brief ASCII text description of the module. The length of the block is 1 ... 64 bytes, as specified in word 6 of the module status block (reference 4F806). The registers can be read, but cannot be written into.

A .2 Write Privilege to Modules

When a node performs the initial write to a TIO module, the module will reserve further write privilege to that node for a duration of 60 seconds, before timing out. If the current node continues to write to the module within 60-second intervals, that node retains the write privilege. If the timeout is allowed to expire, any node may write to the module and the write privilege will be given to the next node that does so.

The 60-second timeout value is fixed, and is not accessible to the application. Note that the timeout process applies only to the write privilege to a module. Reading of input data or status from the module is allowed to any node.

Appendix B
CE Compliance

- Requirements for CE Compliance
- Available Components for CE Compliance
- 170 BDI 542 50 -- Modbus Plus 115 VAC Input Module
- 170 BDO 542 50 -- Modbus Plus 24 ... 230 VAC Output Module

B .1 Requirements for CE Compliance

Certain Modicon TIO products bear the CE logo, indicating compliance with the EMC directives of the European Union. Please note, however, that EMC compliance is not determined solely by the product as shipped, but also by its employment by the user.

To ensure EMC compliance when installing these products, please observe the following measures:

- ☐ install equipment according to approved EMC practice (protective and functional earthing, connections with good conductivity);
- ☐ avoid all sources of electrical disturbance near the equipment;
- ☐ use only manufacturer-approved cable;
- ☐ observe compliant grounding of cable shielding (connections, clamps);
- ☐ use good judgment in cable routing (separate data lines from power lines to avoid electrical disturbance);
- ☐ use prescribed suppression filters and install them properly.

B .1.1 CE-Compliant Wiring Examples

Wiring examples illustrating the connection of CE-compliant filters are provided for a typical TIO AC input and AC output module:

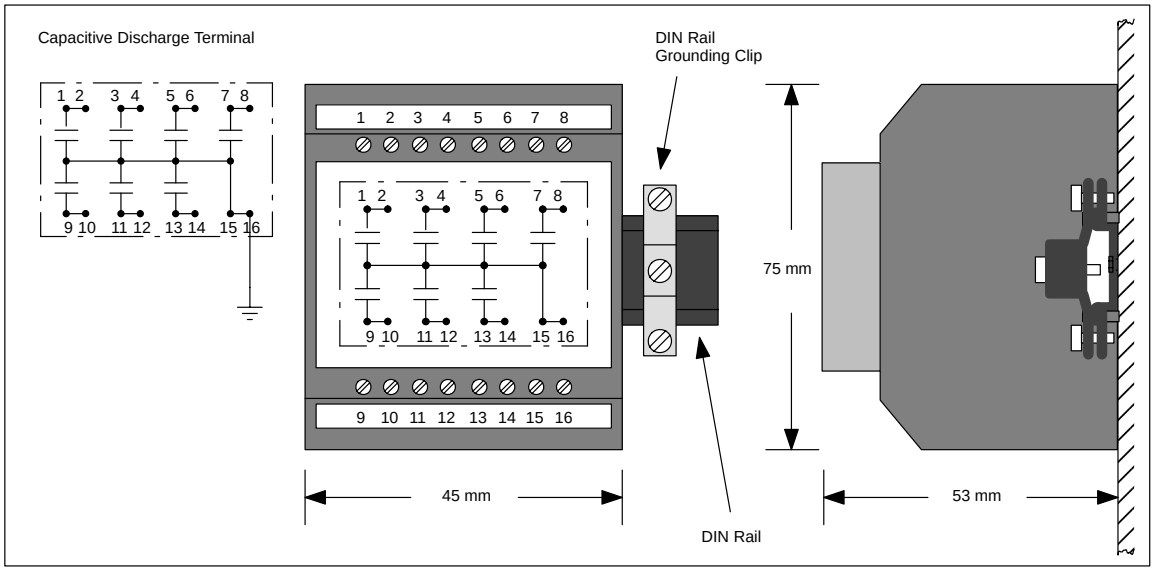
Part Number	Module Type
170 BDI 542 50	Discrete 16 in 115 V ac
170 BDO 542 50	Discrete 16 out 24 ... 230 V ac

B .2 Available Components for CE Compliance

B .2.1 Capacitive Discharge Terminal and DIN Grounding Clip

A CE-compliant Capacitive Discharge Terminal and DIN Rail Grounding Clip are available with the following Modicon part numbers:

Part Number	Description
042244899	Capacitive Discharge Terminal, 2.2 nf
042249007	Grounding Clip, DIN Rail



B .2.2 AC Line Filters

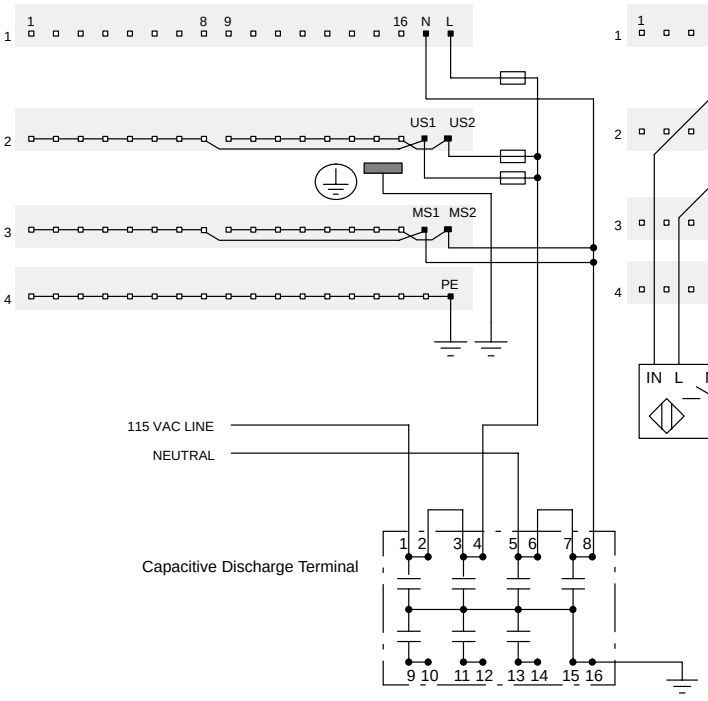
CE-compliant AC Line Filters are available with a variety of wiring connections, including soldering lugs and flexible wire leads. Filters are available from the following sources:

Manufacturer: Schaffner EMC (Specify: FN-670 Series Filters)

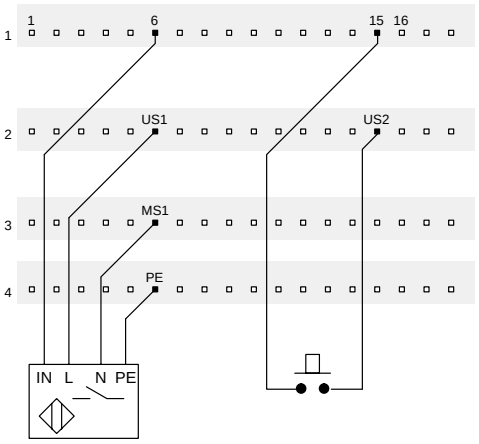
Location	Contact	Telephone	FAX
USA	Schaffner EMC Inc.	(201) 379–7778	(201) 379–1151
France	Schaffner S.A.	(13) 947 86 36	(13) 947 02 28
Germany	Schaffner Elek GmbH	(0721) 56 91 0	(0721) 56 91 10
U.K.	Schaffner EMC Ltd.	(0734) 69 71 79	(0734) 69 98 46

B .3 170 BDI 542 50 –– 115 VAC Input

Connecting Operating Voltages



Connecting Field Devices



PE Ground Wire connection
Minimum wire size 2.5 sq mm
Maximum wire length 25 cm

Common Connections

Row 2: Terminals 1 ... 8 and 17 (US1) are connected together within the module.

Row 2: Terminals 9 ... 16 and 18 (US2) are connected together within the module.

Row 3: Terminals 1 ... 8 and 17 (MS1) are connected together within the module.

Row 3: Terminals 9 ... 16 and 18 (MS2) are connected together within the module.

Row 4: Install an external bus bar at row 4. Terminals 1 ... 18 (PE) are connected together within the external bus bar. There is no connection to the module.

External Fuses

L supply: 100 mA fast blow.

US1 and US2 supply: Select a fuse that meets the total supply requirement of the connected devices. The maximum allowable fuse rating is: 4 A fast blow.

Capacitive Discharge Terminal

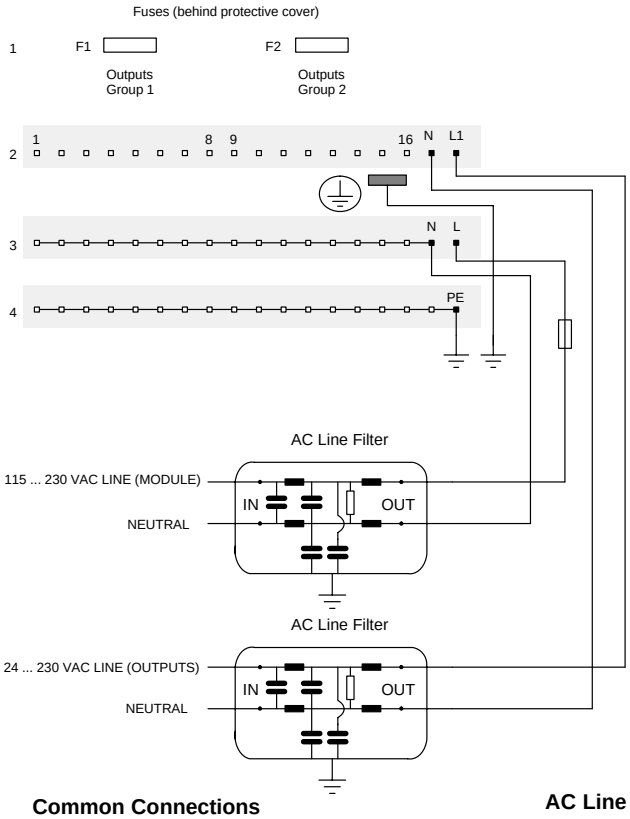
Capacitive Discharge Terminal (Part Number 042244899): 2.2 nf

Labeling of Terminals

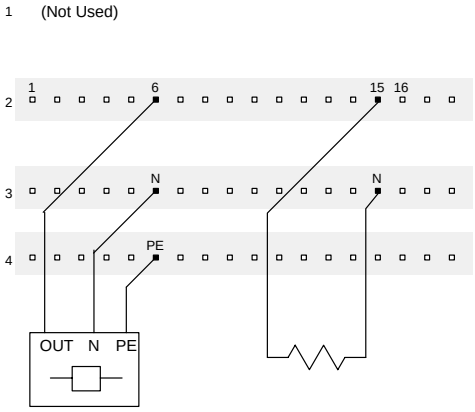
Row	Terminal	Connection	
1	1 ... 8	I1 ... I8	Input points 1 ... 8 (group 1)
1	9 ... 16	I9 ... I16	Input points 9 ... 16 (group 2)
1	17	N	Module operating voltage, Neutral
1	18	L	Module operating voltage, Line
2	17	US1	Voltage for devices 1 ... 8 (group 1)
2	18	US2	Voltage for devices 9 ... 16 (group 2)
3	17	MS1	Voltage return for 1 ... 8 (group 1)
3	18	MS2	Voltage return for 9 ... 16 (group 2)
4	18	PE	Earth ground for field devices
	⏚		Power ground

B .4 170 BDO 542 50 –– 24 ... 230 VAC Output

Connecting Operating Voltages



Connecting Field Devices



Common Connections

Row 3: Terminals 1 ... 17 (N) are connected together within the module.

Row 4: Install an external bus bar at row 4. Terminals 1 ... 18 (PE) are connected together within the external bus bar. There is no connection to the module.

AC Line Filter

Schaffner EMC Filter Series FN670 or equivalent: 10 A 250 V.

Internal Fuses

L1 supply: FF 8 A 250 V fast blow, for each output group. Total fuses: 2.

External Fuse

L supply: 100 mA 250 V fast blow.

Labeling of Terminals

Row	Terminal	Connection	
2	1 ... 8	O1 ... O8	Output points 1 ... 8 (group 1)
2	9 ... 16	O9 ... O16	Output points 9 ... 16 (group 2)
2	17	N	Voltage for field devices, Neutral
2	18	L1	Voltage for field devices, Line
3	17	N	Module operating voltage, Neutral
3	18	L	Module operating voltage, Line
4	18	PE	Earth ground for field devices
	⏚		Power ground