

Modicon TSX Momentum  
Interbus Communication Adapter  
User Guide

870 USE 003 00

10/97



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■ Merlin Gerin ■ Modicon ■ Square D ■ Telemecanique

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# Content

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<b>Preface</b> .....	<b>1</b>
Terminology .....	2
Related Documents .....	3
<b>Chapter 1 Interbus with TSX Momentum Overview</b> .....	<b>5</b>
1.1 General Information on Interbus .....	6
1.2 General Information on the 170 INT 110 00 Communications Adapter .....	7
1.2.1 Compatibility .....	7
1.2.2 Environmental Specification .....	8
1.2.3 Physical Structure .....	8
1.2.4 Function .....	8
1.2.5 Error Control .....	8
1.2.6 Isolation .....	9
1.3 Interbus Configuration with TSX Momentum .....	10
1.4 Configuration Limits .....	12
<b>Chapter 2 Communications Adapter Register Mapping</b> .....	<b>13</b>
2.1 I/O words and ID-code .....	14
2.2 Mapping Data Bits to I/O Base Terminals .....	16
2.2.1 Data Register Mapping for Discrete I/O bases .....	16
2.2.2 Data Register Mapping for Analog I/O bases .....	17
<b>Chapter 3 Module Description of 170 INT 110 00</b> .....	<b>19</b>
3.1 Communication Adapter Overview .....	20
3.2 Preparing the Remote Bus Cable .....	21
3.3 LED Status Displays .....	24
3.4 Technical Specifications .....	25
<b>Appendix</b> .....	<b>27</b>
<b>Appendix A EMC Measures for the Communications Adapter</b> .....	<b>29</b>
A.1 Overvoltage Protection for Remote Bus Lines (lightning protection) .....	30



## Preface



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### Caution

The relevant regulations must be observed for control applications involving safety requirements.

For reasons of safety and to ensure compliance with documented system data, repairs to components should be performed only by the manufacturer.

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## Terminology

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### Note

This symbol emphasizes very important facts.



### Caution

This symbol refers to frequently appearing error sources.



### Warning

This symbol points to sources of danger that may cause financial and health damages or may have other aggravating consequences.



### Expert

This symbol is used when a more detailed information is given, which is intended exclusively for experts (special training required). Skipping this information does not interfere with understanding the publication and does not restrict standard application of the product.



### Tip

This symbol is used for Tips & Tricks.

### Example

This symbol emphasizes the beginning of an example.

Figures are annotated in the spelling corresponding to international practice and approved by SI (Système International d' Unités).

The notation applied to numerical values conforms to international practice, as well as a SI (Système International d' Unités) sanctioned representation. This notational format requires a space between hundreds and thousands, and the use of the decimal point (For example: 12 345.67).

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## Related Documents

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<b>Title</b>	<b>Order-No.</b>
I/O Module Bases for TSX Momentum, User Manual	870 USE 002 00
Modicon Terminal Block I/O Modules Hardware Reference Guide	890 USE 104 00





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# Interbus with TSX Momentum Overview



# 1

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The following topics will be reviewed in this chapter:

- General information on Interbus
- General information on the 170 INT 110 00 communication adapter
- Interbus Configuration with TSX Momentum
- Configuration limits

1.1

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## General Information on Interbus

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Interbus is an open communications standard currently supported by over 200 equipment manufacturers with many diverse products. Interbus is a high speed network design to connect I/O Modules, sensors, actuators and control devices with programmable controllers and computer systems.

Interbus is a master/slave network designed for the efficient exchange of I/O data. It has the capability to communicate with up to 256 devices over a distance of 42,000 feet (13 km) using twisted pair cable, and read 1024 inputs and write 1024 outputs in 4 ms. This provides optimum flexibility in configuration of a control system in terms of the number of I/O drops and communication distances. In addition to system configuration flexibility, Interbus does not compromise system performance or reliability of I/O data. In addition to the Modicon Terminal I/O modules, the use of Interbus compatible control products from other manufacture's provides an easy to integrate, cost effective control system based on an open system architecture. A typical system configuration using Terminalblock I/O Modules together with Momentum I/O modules is shown in Figure 2 (page 11).

The 170 INT 110 00 Interbus Communication Adapter provides the communication interface between Momentum I/O base and the Interbus network. This adapter can be plugged into any Momentum I/O base to create a functional I/O unit on the Interbus network.

## 1.2

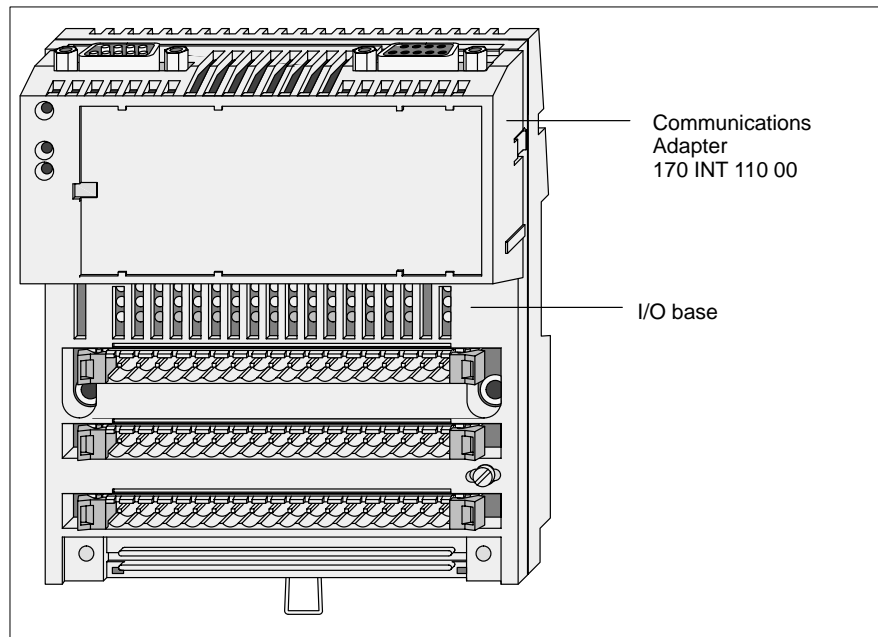
## General Information on the 170 INT 110 00 Communications Adapter

## 1.2.1

### Compatibility

The Interbus communication adapter is compatible with all Momentum I/O bases. It plugs into any I/O base to form a functional I/O unit communicating on the Interbus network. The TSX Momentum I/O modules are designed for connection only to the remote bus of the Interbus network.

**Figure 1 Front view of a TSX Momentum I/O base and Interbus Communication Adapter attached**



TSX Momentum I/O modules operate with every Interbus Master Module which has the Interbus certification.

The 170 INT 110 00 Communications Adapter does not support the PCP protocol.

### 1.2.2 **Environmental Specification**

The adapter conforms to the environmental specification of the I/O base upon which it is installed. For environmental specification refer to the TSX Momentum I/O bases user manual 870 USE 002 00.

### 1.2.3 **Physical Structure**

The communication adapter (safety type IP20) is attached to the I/O base making a connection. Snap–on tabs lock the adapter in place. The adapter can be released with a screwdriver.

With the I/O base there is a label shipped. It fits into an area on the front side of the adapter. In this label, you can write the signal names corresponding to the wired field devices. On the right side of this label, there is a clear window to identify the type of the Communication Adapter.

### 1.2.4 **Function**

The communication adapter has two ports (an incoming remote bus and an outgoing remote bus) implemented as RS 485 interfaces. The incoming remote bus is isolated. The interfaces meet Interbus standards (DIN 19258). Each node regenerates the entire message stream before passing it on the next node. As each node handles the message stream, it extracts the portion of the message that is assigned to that node as input data (into the node), and adds output data (from the node) to the message stream as applicable to that type of node device.

### 1.2.5 **Error Control**

The internal voltage supply (Vcc) is provided by the I/O base. Vcc is monitored and a Reset signal is generated if and when Vcc is not within tolerance. The isolated voltage (Vcx) for the Interbus interface is generated via a DC/DC converter and is not controlled.

A Serial Microprocessor Interface controls three display LEDs which indicate the data transfer (Bus Aktiv, Remote Bus Check, Remote Bus Disabled – refer to "LED Status Displays" page 24). The internal Watchdog timer is 640 ms and when expires the LED "Bus enabled", is lightened.

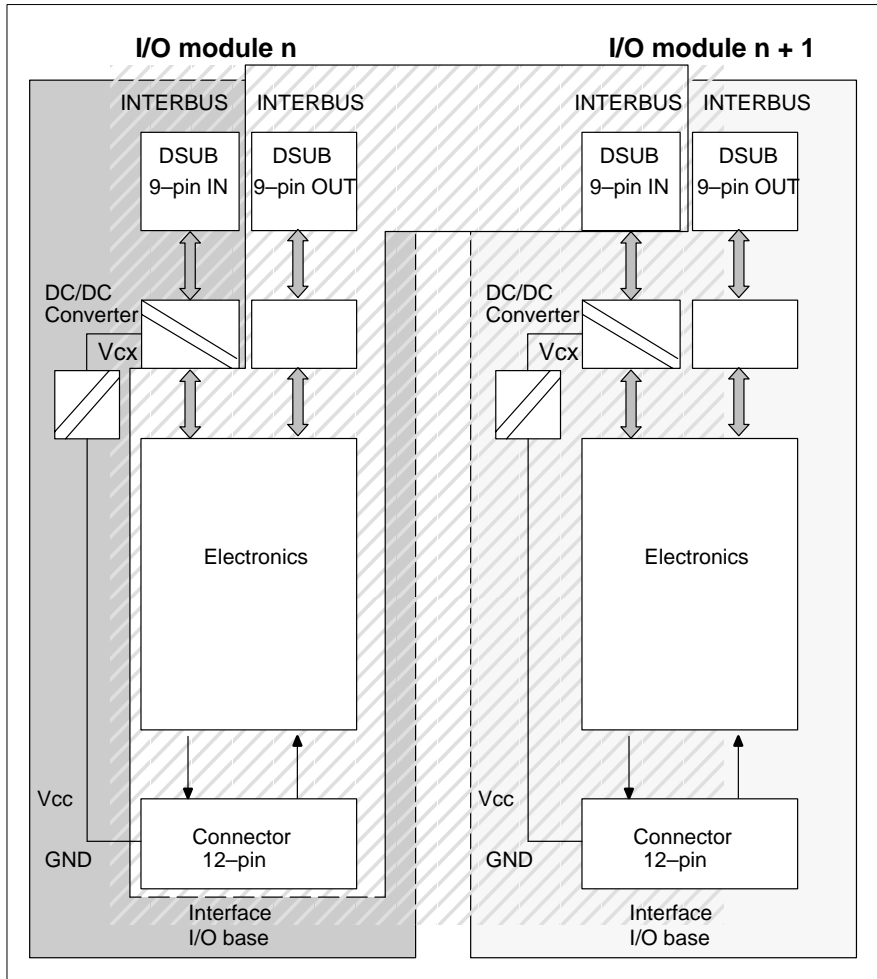
When an I/O base signals an I/O–Error, that signal is transmitted to the bus master via Interbus as a module error.

1.2.6

**Isolation**

The picture shows potential isolation/nonisolation between two I/O modules.

Areas with the same grey color have the same reference potential.



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## Interbus Configuration with TSX Momentum

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The following is a brief summary of the Interbus topology and configuration:

The Interbus serial protocol is implemented as remote and local bus types. Each bus type carries the same signals, but at different electrical levels.

### **Remote Bus**

The remote bus is used for long distance transfer of data, up to 1 200 feet between 2 nodes. Output from the Bus Master board starts the first remote bus. No power passes through the remote bus cable. Electrical voltage levels are RS-485. Network operates at 500 k baud, full duplex. Typical remote bus nodes are, for instance, Momentum I/O modules, TIO modules or branch interfaces. The sections between two remote bus nodes are referred to as remote bus segments.

### **Remote Bus Branch**

The remote bus branch is generated by a branch interface (e.g. 170 BNO 671 00). The branch interface module itself is a remote bus node on the Interbus network. The Momentum I/O Modules can directly connect to the remote bus branch as well as to the remote bus.

### **Installation Remote Bus**

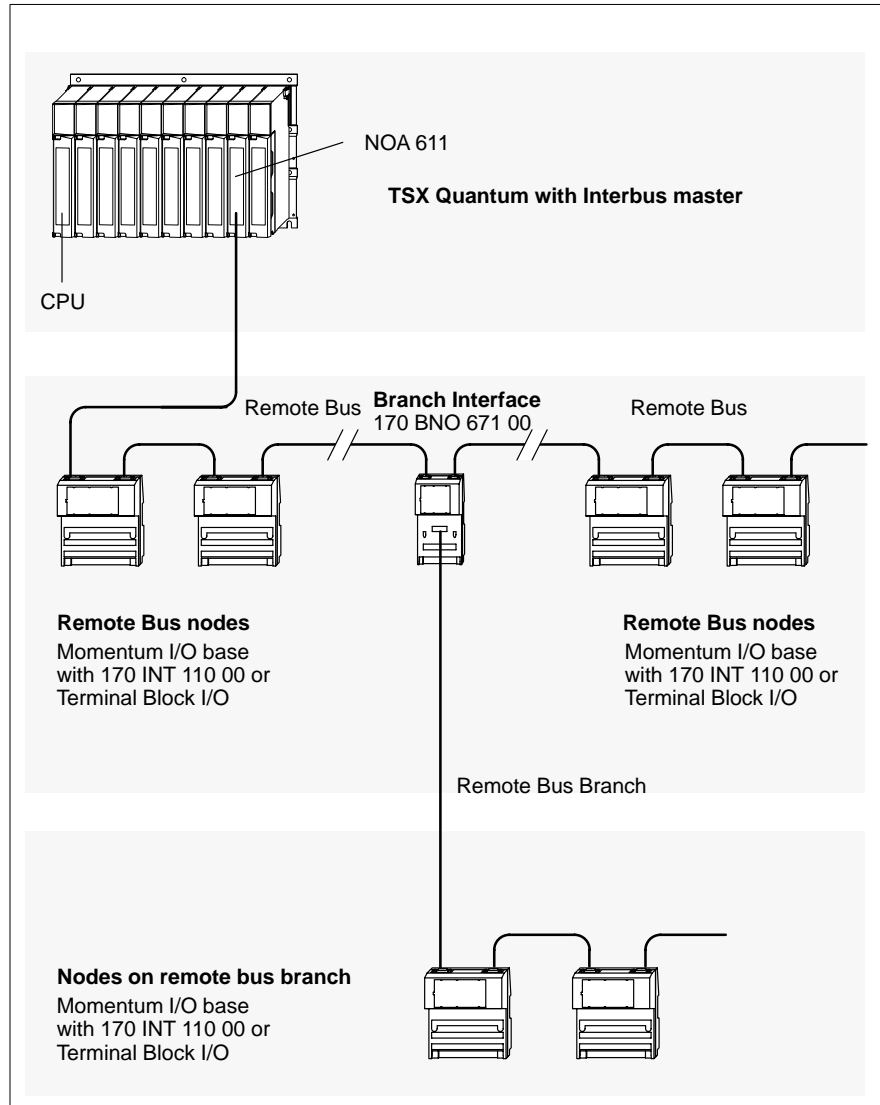
The installation remote bus is generated by specific bus terminal modules. The bus terminal module itself is a remote bus node. The I/O Modules on the installation remote bus are of a special nature, and can only be used on the installation remote bus.



### **Note**

TSX Momentum I/O modules are designed for connection only to the remote bus and the remote bus branch. They cannot be used on the installation field bus.

Figure 2 Example of an Interbus Configuration with Momentum I/O Modules



1.4

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## Configuration Limits

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**Table 1 Interbus Configuration Limits for Standard PLC (e.g. TSX Quantum)**

<b>Parameters</b>	<b>Limitations</b>
max. number of nodes (slaves)	256
max. distance between 2 nodes	Twisted pair, shielded = 400 m (1 200 ft)
max. distance between 2 nodes	Fiber optic (HCS) = 300 m (900 ft)
max. distance between 2 nodes	fiber optic cable, polymer fiber = 50 m (150 ft)
max. length of network	13 km (8 mi)
max. number of I/O points	4096
Transfer Rate	500 kBits/s
Data throughput for 1 000 I/O points	~ 4 ms



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# Communications Adapter Register Mapping

# 2

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The following topics will be reviewed in this chapter:

- I/O words and ID-code
- Mapping Data Bits to I/O Base Terminals

2.1

## I/O words and ID-code

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After the I/O module is powered-up, the identification code (ID code) of the module base is automatically read by the communication adapter. The ID-code provides the Interbus master with the type of data (input or output) and the number of words in the message for each module. After the I/O modules identification codes are received, the Interbus master will automatically begin the execution of I/O data communication in real time.

The length is in each case expressed in I- or O-words, with the higher number being the decisive factor. The number of words it can contain is: 1 to 10, 12, 14, 16, 24 or 32 words.

**Example**

The ID-code for the 170 ADM 350 10 is 0103 hex.

- **01 = Length statement, indicating that the module needs one word (I- or O-word) for data transfer**
- **03 = Module Type, indicates that this module has inputs and outputs**

**Table 2 I/O Base Word Number and ID Code (analog I/O bases)**

Description	Function	I-Words	O-Words	ID Code
170 AAI 140 00	16 input channels	16	4	1033 hex 1651 dec
170 AAI 520 40	4 input channels, RTD, Therm.	4	4	0433 hex 0451 dec
170 AAO 120 00	4 output channels, 0 ... 20 mA		5	0531 hex 0549 dec
170 AAO 921 00	4 output channels, 4 ... 20 mA		5	0531 hex 0549 dec
170 AMM 090 00	4 inputs, 2 outputs (discrete) 4 input & 2 output channels (analog)	1 4	1 4	0533 hex 0551 dec

**Table 3 I/O Base Word Number and ID Codes (discrete I/O bases)**

<b>Description</b>	<b>Function</b>	<b>I–Words</b>	<b>O–Words</b>	<b>ID Code</b>
170 ADI 340 00	16 inputs	1	0	0102
170 ADI 350 00	32 inputs	2	0	0202
170 ADI 540 50	16 inputs	1	0	0102
170 ADO 340 00	16 outputs	0	1	0101
170 ADO 350 00	32 outputs	0	2	0201
170 ADO 530 50	8 outputs	0	1	0101
170 ADO 540 50	16 outputs	0	1	0101
170 ADO 730 50	8 outputs	0	1	0101
170 ADO 740 00	16 outputs	0	1	0101
170 ADM 350 10	16 inputs, 16 outputs	1	1	0103
170 ADM 350 11	16 inputs, 16 outputs	1	1	0103
170 ADM 370 10	16 inputs, 8 outputs	1	1	0103
170 ADM 390 10	16 inputs, 12 outputs	3 (1 discrete and 2 diagnostics)	1	0303
170 ADM 390 30	10 inputs, 8 outputs	1	1	0103
170 ADM 690 50	10 inputs, 8 outputs	1	1	0103

## 2.2 Mapping Data Bits to I/O Base Terminals

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### 2.2.1 Data Register Mapping for Discrete I/O bases

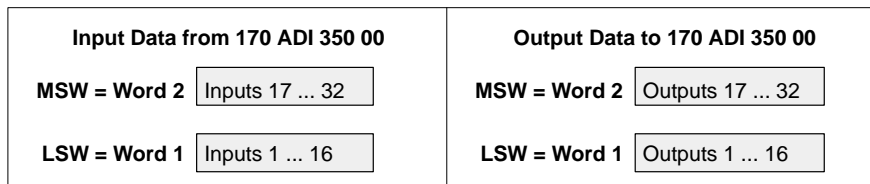
The data transmitted to or from the I/O base are transferred 1 : 1 from/to the communication adapter.

Data in controller registers is mapped to the field terminals of discrete I/O bases in the following way:

- Mapping is done by words (max. 2 for 32 I's or O's).
- The Most Significant Word (MSW) is always sent or received first.
- The words sent by the communications adapter to the I/O base represent the outputs (Output-words).
- The words sent from the I/O base to the communications adapter represent the inputs (Input-words).

Data mapping for two discrete I/O bases is shown as an example:

**Figure 3 I/O Mapping of the 170 ADI 350 00 (32 Inputs) and 170 ADO 350 00 (32 Outputs)**



**Additional documentation: Refer to the I/O bases User Manual (870 USE 002 00) for further information.**

2.2.2

### Data Register Mapping for Analog I/O bases

Data in controller registers is mapped to the field terminals of analog I/O bases in the following way:

- Each analog value is mapped to one word.
- The Most Significant Word (MSW) is sent or received first.
- The words sent by the communications adapter to the I/O base represent the output values and parameters (Output-words).
- The words sent from the I/O base to the communications adapter represent the input values and status (Input-words).

Data mapping for one analog I/O base is shown as an example:

**Figure 4 I/O Mapping of the 170 AAI 140 00 (16 Input Channels) e.g.**

Input Data from 170 AAI 140 00	Output Data to 170 AAI 140 00
MSW = Word 16 <input type="text" value="Value channel 16"/>	MSW = Word 16 <input type="text" value="empty"/>
Word 15 <input type="text" value="Value channel 15"/>	Word 15 <input type="text" value="empty"/>
to	to
Word 5 <input type="text" value="Value channel 5"/>	Word 5 <input type="text" value="empty"/>
Word 4 <input type="text" value="Value channel 4"/>	Word 4 <input type="text" value="Parameters, Channels 13 ... 16"/>
Word 3 <input type="text" value="Value channel 3"/>	Word 3 <input type="text" value="Parameters, Channels 9 ... 12"/>
Word 2 <input type="text" value="Value channel 2"/>	Word 2 <input type="text" value="Parameters, Channels 5 ... 8"/>
LSW = Word 1 <input type="text" value="Value channel 1"/>	LSW = Word 1 <input type="text" value="Parameters, Channels 1 .. 4"/>



**Additional documentation: Refer to the I/O bases User Manual (870 USE 002 00) for further information.**



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## **Module Description of 170 INT 110 00**

# **3**

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The following topics will be reviewed in this chapter:

- Communication Adapter Overview
- Preparing the Remote Bus Cable
- LED Status Displays
- Technical Specifications

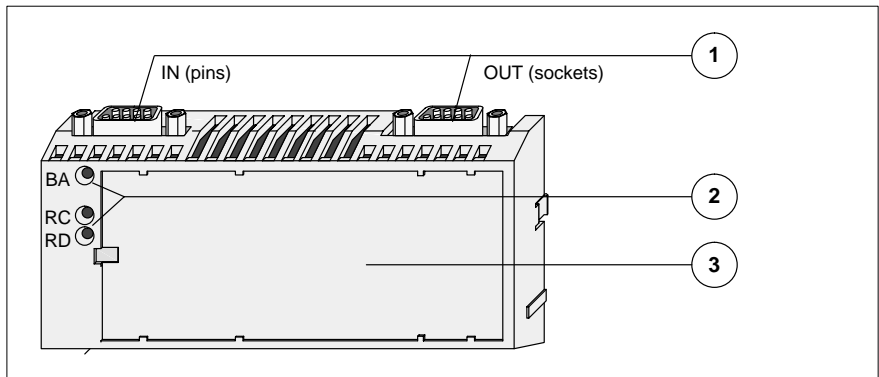
3.1

## Communication Adapter Overview

The Interbus Communication Adapter can be operated with any TSX Momentum I/O base.

**Table 4 Basic Data**

Module Type	Communication Adapter for Interbus,Remote Bus only
Power Supply	5 VDC / 250 mA (from I/O base)
Transfer Rate	500 K bits/s
Bus length	400 m, 1200 ft. (single module spacing) up to 13 000 m, 8 mi (total bus length)



**Module Elements:**

1. Interbus connector
2. LED Display
3. Label (shipped with the I/O base)



3.2

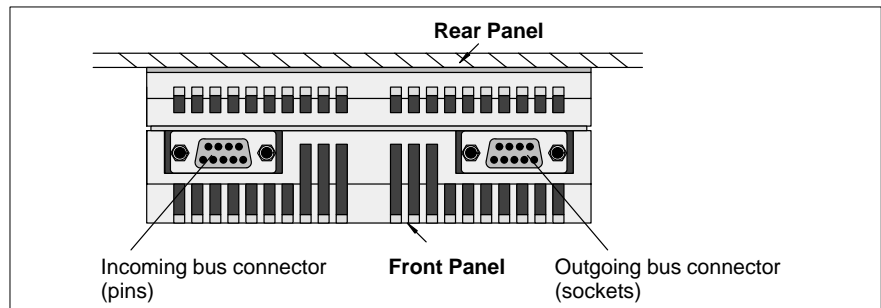
## Preparing the Remote Bus Cable

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

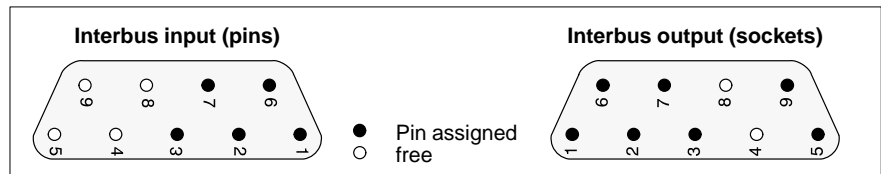
Modules at end sites on the network cable will have one connection. This is to the incoming bus cable only.

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.

**Figure 5 Top view of a TSX Momentum I/O Module base and Interbus Communication Adapter attached**



**Figure 6 Connectors on Interbus Communication Adapter**

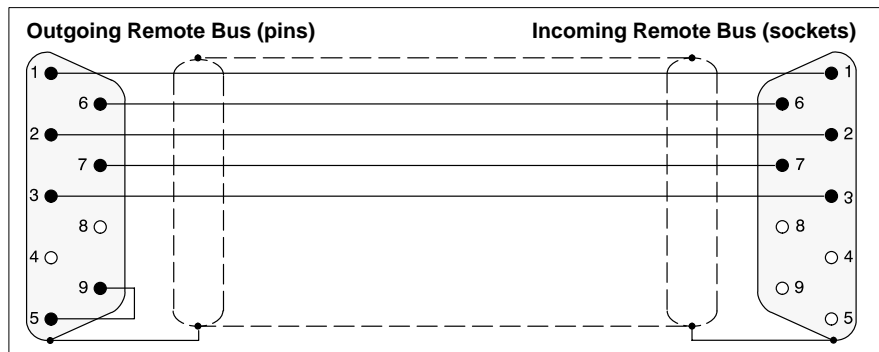


Modicon provides pre-fabricated Interbus cables in four lengths. Each cable has two connectors installed for direct interconnection between two modules. Modicon also provides a connector kit for installation onto user-supplied cable. The kit contains one pin and one socket connector (ordering details see specs).

Please note the following general requirements:

- The maximum remote-bus cable length is 13 km (8 mi.). The cable length between two remote-bus nodes must not exceed 400 m (1200 ft)!
- Ready-made off-the-shelf cables are available for the remote bus: see specs. Custom lengths need to be prepared by the user.
- The connectors for the outgoing remote bus are always pins, those for the incoming remote bus are always sockets.
- In the outgoing remote bus connector, pins 5 and 9 must be connected (refer to schematic the figure below)!
- Connect the cable shield to the connector.
- For the remote bus you will need a 5-wire cable, twisted-pair type, shielded; this cable is available by the meter (KAB-3225-LI).

Wire the connectors of the remote bus cable as follows:

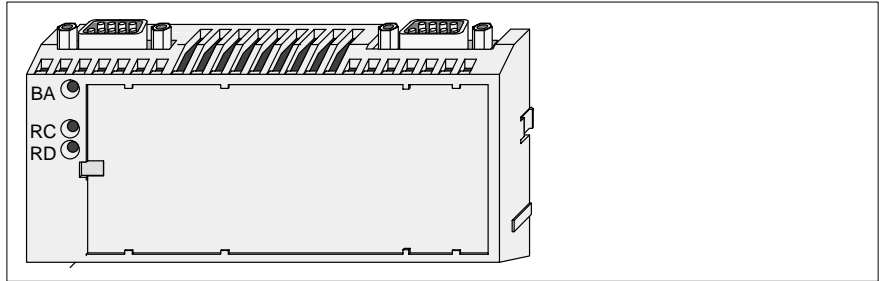


Pin	Wire Color	Connectionoutgoing remote bus	Pin	Wire Color	Connectionoutgoing remote bus
1	yellow	DO – Data Out	1	yellow	DO – Data Out
2	grey	DI – Data IN	2	grey	DI – Data IN
3	brown	Common	3	brown	Common*
4		GND – Reference conductor, fiber-optic adapter	4		GND* – Reference conductor, fiber-optic adapter
5		Vcc – Power supply for fiber-optic adapter	5		Vcc* – Power supply for fiber-optic adapter
6	green	DO_N – Data Out Negated	6	green	DO_N – Data Out Negated
7	pink	DI_N – Data IN Negated	7	pink	DI_N – Data IN Negated
8		Vcc – Additional power supply for fiber-optic adapter	8		Vcc* – Additional power supply for fiber-optic adapter
9		Plug identification	9		not used

\*) physically isolated

3.3

## LED Status Displays



**Table 5 LED Status Displays**

LED	Status	Function
BA	Green	Bus enabled. Data messages are being transmitted.
	Off	No data messages are being transmitted.
RC	Green	Remote Bus Check. Incoming remote bus is correctly connected and the Bus Reset of the Busmaster is disabled.
	Off	Incoming remote bus not connected or incorrectly connected, or Busmaster Bus Reset is enabled.
RD	Red	Remote Bus Disabled. Extended remote bus is switched off.
	Off	Extended remote bus is not switched off.

## 3.4

## Technical Specifications

<b>General</b>	
<b>Power consumption</b>	< 200 mA at 5 V (supplied by I/O base) excluding fiber-optic adapter
	< 400 mA at 5 V (supplied by I/O base) including two fiber-optic adapters
<b>Power dissipation</b>	0.8 W (typ) without fiber-optic adapter
<b>Potential Isolation</b>	
RS 485 (remote bus in)	isolated from remaining logic
RS 485 (remote bus out)	no isolation
<b>Error Detection</b>	
Data Exchange	Red LED for bus errors (RD) and error message from I/O unit (module error).
<b>Fuses</b>	
Supply voltage Vcc	Internal (for bus adapter) – None External (for I/O base – as per default by designating the appropriate I/O base
<b>Interbus Data Interface</b>	
<b>Interface Mapping</b>	
RS 485	refer to Preparing the Remote Bus Cable
<b>Bus Length</b>	<b>Transfer Rate</b>
max. 8 mi. (13 km) over all bus length	500 kBits/s
max. 1 200 ft. (400 m) between 2 modules	500 kBits/s
<b>Option</b>	Fiber-optic Adapter

<b>How to order:</b>	
<b>Description</b>	<b>Part No.</b>
Interbus Communication Adapter	170 INT 110 00
Remote Bus Cable (sold by the meter)	KAB-3225-LI
Interbus connector set, sockets/pins, 9-pin	170 XTS 009 00
Interbus Cable, 11 cm (0.36 ft), with small connectors	170 MCI 007 00
Interbus Cable, 8 cm (0.26 ft) compatible to TIO and Momentum	170 MCI 008 00
Interbus Cable, 25 cm (0.8 ft) compatible to TIO and branch interface	170 MCI 025 00
Interbus Cable, 100 cm (3.3 ft)	170 MCI 100 00
Set of Labels, qu'ty of 10.	170 XCP 100 00

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# Appendix







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## **EMC Measures for the Communications Adapter**



**A**

- 
- Overvoltage Protection for Remote Bus Lines

A.1

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## **Overvoltage Protection for Remote Bus Lines (lightning protection)**

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To protect transmission systems from flash-over voltage surges (e.g. lightning), the remote bus line should be equipped with overvoltage protectors (lightning arrestors) whenever it is installed outside a building. The nominal discharge current should be at least 5 kA, for instance by using a type ARE, Cat. Nr. 919 232 made by

Dehn und Söhne, Postfach 1640, 92 306 Neumarkt, Germany

or

Dehn und Söhne, Hans-Dehn-Str. 1, 92 318 Neumarkt, Germany

Protecting a remote bus cable requires three ARE lightning arrestors per building.



