Twido programmable controllers
Hardware Reference Guide

TWD USE 10AE eng Version 3.2

a brand of Schneider Electric

Telemecanique

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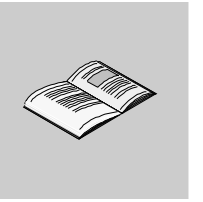
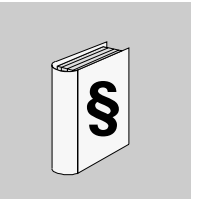


Safety Information



Important Information

NOTICE

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

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

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

⚠ DANGER

DANGER indicates a hazardous situation, which **will result** in death, serious injury or equipment damage.

⚠ WARNING

WARNING indicates a situation presenting risks liable to **provoke** death, serious injury or equipment damage.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation, which, **can result** in personal injury or equipment damage.

PLEASE NOTE

Electrical equipment should be serviced only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material. This document is not intended as an instruction manual for untrained persons. Assembly and installation instructions are provided in the Twido Hardware Reference Manual, TWD USE 10AE.

Additional Safety Information

Those responsible for the application, implementation or use of this product must ensure that the necessary design considerations have been incorporated into each application, completely adhering to applicable laws, performance and safety requirements, regulations, codes and standards.

General Warnings and Cautions

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, BURN OR EXPLOSION

Turn off all power before starting installation, removal, wiring, maintenance or inspection of the smart relay system.

Failure to follow this instruction will result in death or serious injury.

⚠ WARNING

EXPLOSION HAZARD

- Substitution of components may impair suitability for Class I, Div 2 compliance.
- Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

Failure to follow this instruction can result in death, serious injury, or equipment damage.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Turn power off before installing, removing, wiring, or maintaining.
- This product is not intended for use in safety critical machine functions. Where personnel and or equipment hazards exist, use appropriate safety interlocks.
- Do not disassemble, repair, or modify the modules.
- This controller is designed for use within an enclosure.
- Install the modules in the operating environment conditions described.
- Use the sensor power supply only for supplying power to sensors connected to the module.
- For power line and output circuits, use a fuse designed to Type T standards per IEC60127. The fuse must meet the circuit voltage and current requirements.

  Recommended: Littelfuse® 218 Series, 5x20mm time lag (slow blow) fuses.

Failure to follow this instruction can result in death, serious injury, or equipment damage.

Safe Battery Disposal

The TWDLCA•40DRF compact bases use an optional external lithium battery for longer duration of data backup. (Note: The lithium battery is not supplied with the compact bases; you must purchase it separately.)

⚠ WARNING

EXPLOSION AND TOXIC HAZARD

- Do not incinerate a lithium battery for it may explode and release toxic substances.
- Do not handle damaged or leaking lithium battery.
- Dead batteries shall be disposed of properly, for improper disposal of unused batteries can cause harm, as well as environmental damage.
- In some areas, the disposal of lithium batteries with household or business trash collection may be prohibited. In any case, it is your responsibility to always conform to local regulations in your area, as regard to battery disposal.

Failure to follow this instruction can result in death, serious injury, or equipment damage.

Reverse Polarity Warning

Reverse-Polarity at Transistor Output is Not Allowed

The TWDLCA•40DRF compact bases transistor outputs cannot withstand any reverse polarity.

⚠ CAUTION

RISK OF REVERSE-POLARITY DAMAGE AT TRANSISTOR OUTPUTS

- Make sure to conform to the polarity markings on the transistor output terminals.
- Use of a reverse polarity can permanently damage or destroy the output circuits.

Failure to follow this instruction can result in injury or equipment damage.

About the Book

At a Glance

Document Scope	This manual provides parts descriptions, specifications, wiring schematics, installation, set up, and troubleshooting information for all Twido products.
Validity Note	The information in this manual is applicable only for Twido products.
Product Related Warnings	Schneider Electric assumes no responsibility for any errors that appear in this document. No part of this document may be reproduced in any form or means, including electronic, without prior written permission of Schneider Electric.
User Comments	We welcome your comments about this document. You can reach us by e-mail at techpub@schneider-electric.com

Twido Overview

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At a Glance

Introduction

This chapter provides an overview of the Twido products, the maximum configurations, the main functions of the controllers, and an overview of the communication system.

What's in this Chapter?

This chapter contains the following topics:

About Twido

Introduction

The Twido controller is available in two models:
- Compact
- Modular

The Compact controller is available with:
- 10 I/Os
- 16 I/Os
- 24 I/Os
- 40 I/Os

The Modular controller is available with:
- 20 I/Os
- 40 I/Os

Additional I/O can be added to the controllers using expansion I/O modules. They are:
- 15 expansion modules of the digital I/O or relay type
- 8 expansion modules of the analog I/O type

Connecting to an AS-Interface bus interface module also allows you to manage up to 62 slave devices. Use the following module:
- AS-Interface V2 bus interface master module: TWDNOI10M3.

The 24 I/O and 40 I/O compact base controllers and all modular base controllers can connect to a CANopen fieldbus interface module that allows you to manage up to 16 CANopen slave devices (not to exceed 16 Transmit-PDOs (TPDO) and 16 Receive-PDOs (RPDO)). Use the following module:
- CANopen fieldbus interface master module: TWDNCO1M.

There are also several options that can be added to the base controllers:
- Memory cartridges
- Real-Time Clock (RTC) cartridge
- Communication adapters
- Communication expansion modules (Modular controller only)
- Ethernet interface module (all Modular and Compact controllers, except TWDLCAE40DRF with on-board Ethernet interface)
- Operator display module (Compact controller only)
- Operator display expansion module (Modular controller only)
- Input simulators (Compact controller only)
- Programming cables
- Digital I/O cables
- Telefast® pre-wired systems with I/O interfaces

Advanced integrated features are provided on the TWDLCAA40DRF and TWDLCAE40DRF series compact base controllers:
- Built-in 100Base-TX Ethernet network port: TWDLCAE40DRF only
- Onboard Real-Time Clock (RTC): TWDLCAA40DRF and TWDLCAE40DRF
- A fourth Fast Counter (FC):TWDLCAA40DRF and TWDLCAE40DRF
- External battery support:TWDLCAA40DRF and TWDLCAE40DRF

Controller Models

The following table lists the controllers:

Controller Name	Reference	Channels	Channel type	Input/Output type	Power supply
Compact 10 I/O	TWDLCAA10DRF	6	Inputs	24 VDC	100/240 VAC
		4	Outputs	Relay	
Compact 10 I/O	TWDLCDA10DRF	6	Inputs	24 VDC	24 VDC
		4	Outputs	Relay	
Compact 16 I/O	TWDLCAA16DRF	9	Inputs	24 VDC	100/240 VAC
		7	Outputs	Relay	
Compact 16 I/O	TWDLCDA16DRF	9	Inputs	24 VDC	24 VDC
		7	Outputs	Relay	
Compact 24 I/O	TWDLCAA24DRF	14	Inputs	24 VDC	100/240 VAC
		10	Outputs	Relay	
Compact 24 I/O	TWDLCDA24DRF	14	Inputs	24 VDC	24 VDC
		10	Outputs	Relay	
Compact 40 I/O	TWDLCAA40DRF	24 16	Inputs Outputs	24 VDC Relay X 14 Transistors X 2	100/240 VAC
Compact 40 I/O	TWDLCAE40DRF	24 16	Inputs Outputs	24 VDC Relay X 14 Transistors X 2 Ethernet port	100/240 VAC
Modular 20 I/O	TWDLMDA20DUK	12	Inputs	24 VDC	24 VDC
		8	Outputs	Transistor sink	
Modular 20 I/O	TWDLMDA20DTK	12	Inputs	24 VDC	24 VDC
		8	Outputs	Transistor source	
Modular 20 I/O	TWDLMDA20DRT	12	Inputs	24 VDC	24 VDC
		6 2	Outputs Outputs	Relay Transistor source	
Modular 40 I/O	TWDLMDA40DUK	24	Inputs	24 VDC	24 VDC
		16	Outputs	Transistor sink	
Modular 40 I/O	TWDLMDA40DTK	24	Inputs	24 VDC	24 VDC
		16	Outputs	Transistor source	

Digital Expansion I/O Modules

The following table lists the digital and relay expansion I/O modules:

Module Name	Reference	Channels	Channel type	Input/Output type	Terminal type
Input modules					
8-point input	TWDDDI8DT	8	Inputs	24 VDC	Removable terminal block
8-point input	TWDDAI8DT	8	Inputs	120 VAC	Removable terminal block
16-point input	TWDDDI16DT	16	Inputs	24 VDC	Removable terminal block
16-point input	TWDDDI16DK	16	Inputs	24 VDC	Connector
32-point input	TWDDDI32DK	32	Inputs	24 VDC	Connector
Output Modules					
8-point output	TWDDD08UT	8	Outputs	Transistor sink	Removable terminal block
8-point output	TWDDD08TT	8	Outputs	Transistor source	Removable terminal block
8-point output	TWDDRA8RT	8	Outputs	Relay	Removable terminal block
16-point output	TWDDRA16RT	16	Outputs	Relay	Removable terminal block
16-point output	TWDDDO16UK	16	Outputs	Transistor sink	Connector
16-point output	TWDDDO16TK	16	Outputs	Transistor source	Connector
32-point output	TWDDDO32UK	32	Outputs	Transistor sink	Connector
32-point output	TWDDDO32TK	32	Outputs	Transistor source	Connector
Mixed modules					
4-point input/4-point output	TWDDMM8DRT	4	Inputs	24 VDC	Removable terminal block
		4	Outputs	Relay	
16-point input/8-point output	TWDDMM24DRF	16	Inputs	24 VDC	Non-removable terminal block
		8	Outputs	Relay	

Analog Expansion I/O Modules

The following table lists the analog expansion I/O modules:

Module name	Reference	Channel	Channel type	Details	Terminal type
2 high level inputs	TWDAMI2HT	2	Inputs	12 bits 0-10V, 4-20mA	Removable terminal block
1 high level output	TWDAMO1HT	1	Outputs	12 bits 0-10V, 4-20mA	
2 high level inputs/1 output	TWDAMM3HT	2	Inputs	12 bits 0-10V, 4-20mA	
		1	Output	12 bits 0-10V, 4-20mA	
2 low level inputs/1 high level output	TWDALM3LT	2	Inputs	12 bits Thermocouple, RTD	
		1	Output	12 bits 0-10V, 4-20mA	
2 high level outputs	TWDAVO2HT	2	Outputs	11 bits + sign, +/-10V	
4 low level inputs	TWDAMI4LT	4	Inputs	12 bits 0-10V, 0-20mA, 3-wire PT100, PT1000, NI100 and NI1000	
8 high level inputs	TWDAMI8HT	8	Inputs	10 bits 0-10V, 0-20mA	
	TWDARI8HT	8	Inputs	10 bits, NTC or PTC sensors	

AS-Interface V2 bus master module

The following table lists the specifications of the AS-Interface V2 bus master module:

Module name	Reference	Number of slaves	Maximum number of channels	Power supply	Terminal type
AS-Interface master	TWDNOI10M3	Maximum 62	248 inputs 186 outputs	30 VDC	Removable terminal block

CANopen fieldbus master module

The following table lists the specifications of the CANopen fieldbus master module:

Module name	Reference	Number of slaves	Maximum number of channels	Power supply	Terminal type
CANopen master	TWDNCO1M	Maximum 16	16 TPDOs 16 RPDOs	24 VDC	Removable terminal block

Telefast® pre-wired systems

The following table lists the various Telefast® bases for Twido:

I/O sub-bases	Reference	Inputs	Outputs
For Twido modular base controllers	ABE 7B20MPN20	12 inputs	8 passive outputs
	ABE 7B20MPN22	12 inputs	8 passive outputs with individual fuse protection and LED
	ABE 7B20MRM20	12 inputs	8 outputs with soldered relays
For Twido expansion modules	ABE 7E16EPN20	16 passive inputs	—
	ABE 7E16SPN20	—	16 passive outputs
	ABE 7E16SPN22	—	16 passive outputs with indivdual fuse protection and LED
	ABE 7E16SRM20	—	16 soldered relay outputs
Optional terminal blocks	ABE 7BV20TB	12 shunted screw terminals for the input common	8 shunted screw terminals for the output common
	ABE 7BV20	20 shunted screw terminals for connection of a single common	

Options

The following table lists the options:

Option name	Reference
Operator display module	TWDXCPODC
Operator display expansion module	TWDXCPODM
Real Time Clock (RTC) cartridge	TWDXCPRTC
32 Kb EEPROM memory cartridge	TWDXCPMFK32
64 Kb EEPROM memory cartridge	TWDXCPMFK64
Communication adapter, RS485, miniDIN	TWDNAC485D
Communication adapter, RS232, miniDIN	TWDNAC232D
Communication adapter, RS485, terminal	TWDNAC485T
Communication expansion module, RS485, miniDIN	TWDNOZ485D
Communication expansion module, RS232, miniDIN	TWDNOZ232D
Communication expansion module, RS485, terminal	TWDNOZ485T
ConneXium TwidoPort Ethernet interface module	499TWD01100
6-point input simulator	TWDXSM6
9-point input simulator	TWDXSM9
14-point input simulator	TWDXSM14
External backup battery (TWDLCA•40DRF only)	TSXPLP01 (single battery order) TSXPLP101 (10 pack order)
5 mounting strips	TWDDXMT5

Option name	Reference
2 terminal blocks (10 positions)	TWDFTB2T10
2 terminal blocks (11 positions)	TWDFTB2T11
2 terminal blocks (13 positions)	TWDFTB2T13
2 terminal blocks (16 positions)	TWDFTB2T16T
2 connectors (20 pins)	TWDFCN2K20
2 connectors (26 pins)	TWDFCN2K26

Cables

The following table lists the cables:

Cable name	Reference
Programming cables	
PC to controller programming cable: Serial	TSXPCX1031
PC to controller programming cable: USB	TSXPCX3030
Mini-DIN to free wire communication cable	TSXCX100
Digital I/O Cables	
3 meter, connector for controller to free wire	TWDFCW30M
5 meter, connector for controller to free wire	TWDFCW50M
3 meter, connector for expansion I/O module to free wire	TWDFCW30K
5 meter, connector for expansion I/O module to free wire	TWDFCW50K
AS-Interface Cables	
Standard two-wire AS-Interface ribbon cable for sending data and power to slave devices	see AS-Interface Wiring System catalog available from your local Schneider representative
Standard two-wire round cable for sending data and power to slave devices	see AS-Interface Wiring System catalog available from your local Schneider representative
Telefast® Cables for Twido base controllers and expansion modules	
for Twido modular base controllers	
Cable equipped with a 26-way HE 10 connector at each end. (AWG 28 / 0.08 mm^2; length: 0.5 m / 1.64 ft)	ABF T26B050
Cable equipped with a 26-way HE 10 connector at each end. (AWG 28 / 0.08 mm^2; length: 1 m / 3.28 ft)	ABF T26B100

Cable name	Reference
Cable equipped with a 26-way HE 10 connector at each end. (AWG 28 / 0.08 mm^2; length: 2 m / 6.56 ft)	ABF T26B200
for Twido discrete I/O expansion modules	
Cable equipped with a 20-way HE 10 connector at each end. (AWG 28 / 0.08 mm^2; length: 0.5 m / 1.64 ft)	ABF T20E050
Cable equipped with a 20-way HE 10 connector at each end. (AWG 28 / 0.08 mm^2; length: 1 m / 3.28 ft)	ABF T20E100
Cable equipped with a 20-way HE 10 connector at each end. (AWG 28 / 0.08 mm^2; length: 2 m / 6.56 ft)	ABF T20E200
Ethernet Connection Cable	
SFTP Cat5 RJ45 Ethernet cable	490NTW000••

Maximum Hardware Configuration

Introduction

This section provides the maximum hardware configurations for each controller.

Maximum Hardware Configurations - Compact Controllers

The following table lists the maximum number of configuration items for each compact controller:

Controller Item	Compact controller			
TWD...	**LCAA10DRF LCDA10DRF**	**LCAA16DRF LCDA16DRF**	**LCAA24DRF LCDA24DRF**	**LCAA40DRF LCAE40DRF**
Standard digital inputs	6	9	14	24
Standard digital outputs	4	7	10	16 (14 Relay + 2 Transistor outputs)
Max expansion I/O modules (Digital or analog)	0	0	4	7
Max digital inputs (controller I/O + exp I/O)	6	9	14+(4x32)=142	24+(7x32)=248
Max digital outputs (controller I/O + exp I/O)	4	7	10+(4x32)=138	16+(7x32)=240
Max digital I/O (controller I/O + exp I/O)	10	16	24+(4x32)=152	40+(7x32)=264
Max AS-Interface bus interface modules	0	0	2	2
Max I/O with AS-Interface modules (7 I/O per slave)	10	16	24+(2x62x7)=892	40+(2x62x7)=908
Max CANopen fieldbus master modules	0	0	1	1
Max T/R-PDOs with CANopen devices	0	0	16 TPDOs 16 RPDOs	16 TPDOs 16 RPDOs
Max relay outputs	4 base only	7 base only	10 base + 32 expansion	14 base + 96 expansion
Potentiometers	1	1	2	2
Built-in analog inputs	0	0	0	0
Max analog I/O (controller I/O + exp I/O)	0 in / 0 out	0 in / 0 out	8 in / 4 out	15 in / 7 out
Remote controllers	7	7	7	7

Controller Item	**Compact controller**			
TWD...	**LCAA10DRF LCDA10DRF**	**LCAA16DRF LCDA16DRF**	**LCAA24DRF LCDA24DRF**	**LCAA40DRF LCAE40DRF**
Serial ports	1	2	2	2
Ethernet port	0	0	0	1 (TWDLCA-E40DRF only)
Cartridge slots	1	1	1	1
Largest application/backup size (KB)	8	16	32	64
Optional memory cartridge (KB)	32[1]	32[1]	32[1]	32 or 64[2]
Optional RTC cartridge	yes[1]	yes[1]	yes[1]	RTC onboard[3]
Optional Operator Display	yes	yes	yes	yes
Optional 2nd port	no	yes	yes	yes
Optional Ethernet interface module	yes	yes	yes	yes (TWDLC-AA40DRF) no (TWDLC-AE40DRF)

Note:
1. A Compact controller can have either a memory cartridge or an RTC cartridge.
2. Memory cartridge only, for RTC is already onboard.
3. Both TWDLCA40DRF and TWDLCAE40DRF compact controllers have a built-in RTC. Therefore, no RTC cartridge can be added on those controllers, but only a memory cartridge.

Maximum Hardware Configurations - Modular Controllers

The following table lists the maximum number of configuration items for each modular controller:

Controller Item	Modular controller		
TWD...	**LMDA20DUK LMDA20DTK**	**LMDA20DRT**	**LMDA40DUK LMDA40DTK**
Standard digital inputs	12	12	24
Standard digital outputs	8	8	16
Max expansion I/O modules (Digital or analog)	4	7	7
Max digital inputs (controller I/O + exp I/O)	12+(4x32)=140	12+(7x32)=236	24+(7x32)=248
Max digital outputs (controller I/O + exp I/O)	8+(4x32)=136	8+(7x32)=232	16+(7x32)=240
Max digital I/O (controller I/O + exp I/O)	20+(4x32)=148	20+(7x32)=244	40+(7x32)=264
Max AS-Interface bus interface modules	2	2	2
Max I/O with AS-Interface modules (7 I/O per slave)	20+(2x62x7)=888	20+(2x62x7)=888	40+(2x62x7)=908
Max CANopen fieldbus interface modules	1	1	1
Max T/R-PDOs with CANopen devices	16 TPDOs 16 RPDOs	16 TPDOs 16 RPDOs	16 TPDOs 16 RPDOs
Max relay outputs	64 expansion only	6 base + 96 expansion	96 expansion only
Potentiometers	1	1	1
Built-in analog inputs	1	1	1
Max analog I/O (controller I/O + exp I/O)	9 in / 4 out	15 in / 7 out	15 in / 7 out
Remote controllers	7	7	7
Serial ports	2	2	2
Cartridge slots	2	2	2
Largest application/backup size (KB)	32	64	64
Optional memory cartridge (KB)	32	32 or 64	32 or 64
Optional RTC cartridge	yes	yes	yes
Optional Operator Display	yes[2]	yes[2]	yes[2]
Optional Ethernet interface module	yes	yes	yes

Note:
1. A Compact controller can have either a memory cartridge or an RTC cartridge.
2. A Modular controller can have either an Operator Display expansion module (with an optional communication adapter) or a communication expansion module.

Main Functions of the Controllers

Introduction

By default all I/O on the controllers are configured as digital I/O. However, certain I/O can be assigned to specific tasks during configuration such as:

- RUN/STOP input
- Latching inputs
- Fast counters:
  - Single up/down counters: 5 kHz (1-phase)
  - Very fast counters: Up/down counters - 20 kHz (2-phase)
- Controller status output
- Pulse Width Modulation (PWM)
- Pulse (PLS) generator output

Twido controllers are programmed using TwidoSoft which enables the following functions to be used on:

- PWM
- PLS
- Fast counters and very fast counters
- PID and PID Auto-Tuning

Main Functions

The following table lists the main functions of the controllers:

Function	Description
Scanning	Normal (cyclical) or periodic (constant) (2 to 150 ms)
Execution time	0.14 µs to 0.9 µs for a list instruction
Memory capacity	Data: 3000 memory words for all controllers, 128 memory bits for TWDLCAA10DRF and TWDLCAA16DRF, 256 memory bits for all other controllers.
	Program: 10 I/O compact controller: 700 list instructions 16 I/O compact controller: 2000 list instructions 24 I/O compact, and 20 I/O modular controllers: 3000 list instructions 20 I/O modular and 40 I/O modular controllers, and 40 I/O compact controllers: 6000 list instructions (with a 64 Kb cartridge, otherwise 3000 list instructions)
RAM backup	• All controllers: By lithium internal battery. Backup duration is approximately 30 days (typical) at 25°C (77°F) after battery is fully charged. The charging time is 15 hours for charging from 0 to 90% of full charge. Battery life is 10 years when charging for 9 hours and discharging for 15 hours. The battery cannot be replaced. • 40DRF compact controllers: By user-replaceable lithium external battery (in addition to internal battery onboard). Backup duration is approximately 3 years (typical) at 25°C (77°F) under normal operating condition of the controller (typically, no long-term powering off of the controller). BAT LED on front-panel provides indication of status for battery-power.
Programming port	• All controllers: EIA RS-485 • TWDLCAE40DRF compact controller: Built-in RJ45 Ethernet communications port
Expansion I/O modules	10 and 16 I/O compact controllers: no expansion modules 24 I/O compact and 20 I/O modular controllers: up to 4 expansion I/O modules 40 I/O modular and 40 I/O compact controllers: up to 7 expansion I/O modules

Function	Description	
AS-Interface V2 bus interface modules	10 and 16 I/O compact controllers: no AS-Interface bus interface module 24 I/O and 40 I/O compact, 20 I/O and 40 I/O modular controllers: up to 2 AS-Interface bus interface modules	
CANopen fieldbus interface modules	10 and 16 I/O compact controllers: no CANopen fieldbus interface module 24 I/O and 40 I/O compact, 20 I/O and 40 I/O modular controllers: 1 CANopen fieldbus interface module	
Remote link communication	Maximum 7 slaves by remote I/O or peer controllers. Maximum length of entire network: 200 m (650 feet).	
Modbus communication	Non-isolated EIA RS-485 type, maximum length limited to 200 m. ASCII or RTU mode.	
Ethernet communication	TWDLCAE40DRF compact controller and 499TWD01100 Ethernet interface module: 100Base-TX auto-negotiated type Ethernet communications over TCP/IP protocol, via built-in RJ45 port.	
ASCII communication	Half-duplex protocol to a device.	
Dedicated function blocks	PWM/PLS	All modular and 40 I/O compact controllers: 2
	Fast counters	TWDLCA•40DRF Compact controllers: 4 All other compact controllers: 3 All modular controllers: 2
	Very fast counters	TWDLCA•40DRF compact controllers: 2 All other compact controllers: 1 All modular controllers: 2
Analog potentiometers	24 I/O and 40 I/O compact controllers: 2 All other controllers: 1	
Built-in analog channel	Compact controllers: none Modular controllers: 1 input	
Programmable input filter	Input filter time can be changed during configuration No filtering or filtering at 3 ms or 12 ms I/O points are configured in groups	
Special I/O	Inputs	RUN/STOP: Any one of the base inputs
		Latching: up to 4 inputs (%I0.2 to %I0.5)
		Built-in analog input connected to %I0.0 according to frequency meter
		Fast counters: 5 kHz maximum Very fast counters: 20 kHz maximum Frequency meter: 1 kHz to 20 kHz maximum
	Outputs	Controller status output: 1 of 3 outputs (%Q0.1 to %Q0.3)
		PLS: 7 kHz maximum
		PWM: 7 kHz maximum

Communication Overview

Introduction

Twido controllers have one, or an optional second, serial port that is used for real-time or system management services. The real-time services provide data distribution functions for exchanging data with I/O devices and messaging functions for communicating to external devices. System management services manage and configure the controller through TwidoSoft. Either serial port is used for any of these services but only serial port 1 is for communicating with TwidoSoft.
To provide these services, there are three protocols available on each controller:

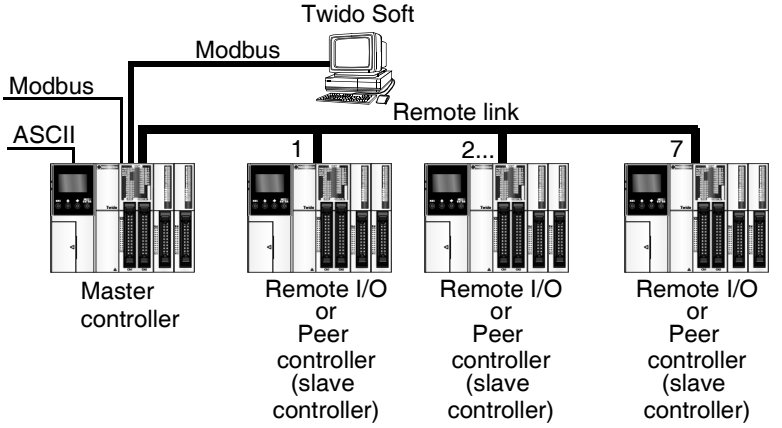
- Remote Link
- Modbus
- ASCII

In addition, the TWDLCAE40DRF compact controller features a built-in RJ45 Ethernet communications port allowing to perform all real-time communications and system management tasks via the network. Ethernet communications implements the following protocol:

- Modbus TCP/IP

Communications Architecture

The following diagram shows a communication architecture with all three protocols.



Note: Communication between the "Modbus" and "Remote Link" protocols cannot occur at the same time.

Remote Link Protocol

The Remote Link protocol is a high-speed master/slave bus designed to communicate a small amount of data between the Master controller and up to seven Remote Slave controllers. Application or I/O data is transferred, depending on the configuration of the Remote controller. A combination of Remote controller types is possible where some can be Remote I/O and some can be Peer controllers.

Modbus Protocol

The Modbus protocol is a master/slave protocol that allows for one master to request responses from slaves or to take action based on the request. The master can address individual slaves or can initiate a broadcast message to all slaves. Slaves return a message (response) to queries that are addressed to them individually. Responses are not returned to broadcast queries from the master.
Modbus Master Mode - The Modbus master mode allows the controller to initiate a Modbus query transmission, with a response expected from a Modbus slave.
Modbus slave mode - Modbus slave mode enables the controller to respond to Modbus queries from a master. This is the default communications mode if no communication is configured.

Modbus TCP/IP Protocol

Note: Modbus TCP/IP is solely supported by TWDLCAE40DRF compact controllers with built-in Ethernet network interface.

The following information describes the Modbus Application Protocol (MBAP).
The Modbus Application Protocol (MBAP) is a layer-7 protocol providing peer-to-peer communication between programmable logic controllers (PLCs) and other nodes on a LAN.
The Twido controller TWDLCAE40DRF implements Modbus TCP/IP Client/Server communications over the Ethernet network. Modbus protocol transactions are typical request-response message pairs. A PLC can be both client and server depending on whether it is querying or answering messages. A Modbus TCP/IP Client is equivalent to a Modbus Master controller in legacy Modbus, while a Modbus TCP/IP Server would correspond to a legacy Modbus Slave controller.

ASCII Protocol

The ASCII protocol allows communication between the controller and a simple device such as a printer.

Descriptions, Specifications, and Wiring

2

At a Glance

Introduction

This chapter provides wiring rules and recommendations, overviews, parts descriptions, specifications, and wiring schematics for the Twido products.

What's in this Chapter?

This chapter contains the following sections:

2.1 Wiring Rules and Recommendations

Wiring Rules and Recommendations

Introduction

There are several rules that must be followed when wiring a controller or module. Recommendations, when needed, are provided on how to comply with the rules.

⚠ DANGER

ELECTRIC SHOCK

- Be sure to remove ALL power from ALL devices before connecting or disconnecting inputs or outputs to any terminal or installing or removing any hardware.
- Be sure to connect the grounding wire to a proper ground.

Failure to follow this instruction will result in death, serious injury, or equipment damage.

⚠ WARNING

FAILURE OF OUTPUTS

If outputs should fail, outputs may remain on or off. Where personnel and or equipment hazards exist, use appropriate safety interlocks.

Failure to follow this instruction can result in death, serious injury, or equipment damage.

Rules

- Each terminal accepts up to two 18 AWG (0.82 mm^2) through 28 AWG (0.08 mm^2) fitted with cable ends or tags.
- Output module fusing is the responsibility of the user. It is not within the Twido product itself. Select a fuse appropriate for the load with respect to the electrical codes.
- Depending on the load, a protection circuit may be needed for relay outputs on modules.
- The power supply wire should be between 18 AWG (0.82 mm^2) and 22 AWG (0.33 mm^2). Use the shortest wire length possible.
- The grounding wire should be 16 AWG (1.30 mm^2).
- Power supply wires routed inside the panel must be kept separate from power wires, I/O wiring and communication wiring. Route wiring in separate cable ducting.
- Take care when wiring output modules that are designed to work as either source or sink. Incorrect wiring can cause equipment damage.
- Make sure that the operating conditions and environments are within the specification values.
- Use proper wire size to meet voltage and current requirements.

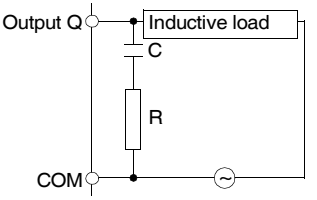
Terminal Tightening Torque

Recommended tightening torque of terminal blocks is listed for all products on the product label.

Contact Protection Circuit for Relay and Transistor Outputs

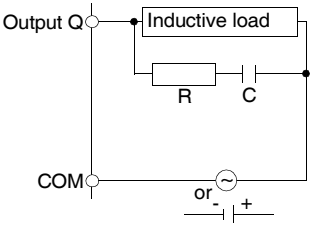
Depending on the load, a protection circuit may be needed for the relay output on the controllers and certain modules. Choose a protection circuit, from the following diagrams, according to the power supply. Connect the protection circuit to the outside of the controller or relay output module.

Protective circuit A: this protection circuit can be used when the load impedance is smaller than the RC impedance in an AC load power circuit.



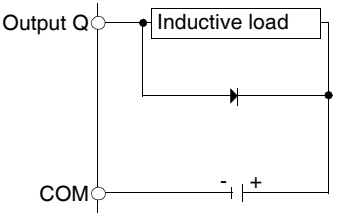
- C represents a value from 0.1 to 1 μF.
- R represents a resistor of approximately the same resistance value as the load.

Protective circuit B: this protection circuit can be used for both AC and DC load power circuits.



- C represents a value from 0.1 to 1 μF.
- R represents a resistor of approximately the same resistance value as the load.

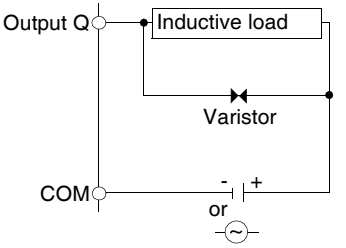
Protective circuit C: this protection circuit can be used for DC load power circuits.



Use a diode with the following ratings:

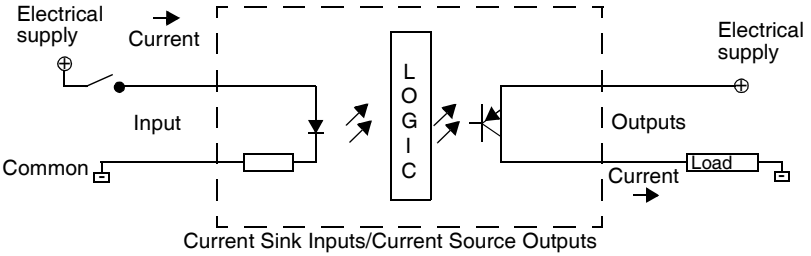
- Reverse withstand voltage: power voltage of the load circuit x 10.
- Forward current: more than the load current.

Protective circuit D: this protection circuit can be used for both AC and DC load power circuits.



Explanation of Source Inputs/ Sink Outputs

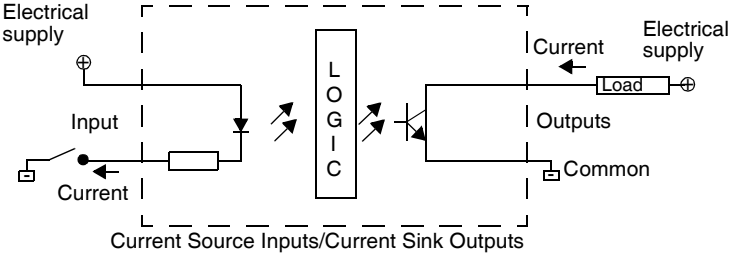
Note: Sink corresponds to the sensors' common on the (+) terminal of the power supply.



Input side COM field terminal connects to the "-" terminal or common of the field power supply. Output side COM field terminal connects to +24V field power supply.

Explanation of Sink Inputs/ Source Outputs

Note: Source corresponds to the sensors' common on the (-) terminal of the power supply.



Input side COM field terminal connects to +24V field power supply. Output side COM field terminal connects to the "-" terminal or common of the field power supply.

2.2 Compact Controller

At a Glance

Introduction

This section provides an overview, parts description, specifications, and wiring schematics of the Compact controllers.

What's in this Section?

This section contains the following topics:

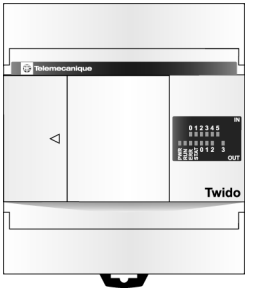
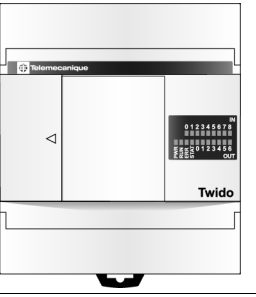
Overview of Compact Controllers

Introduction

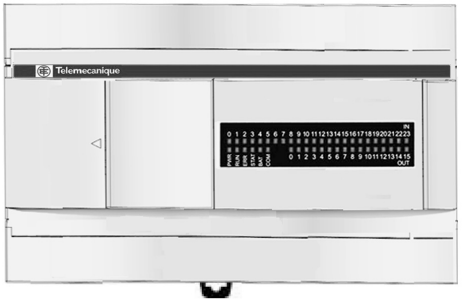
The information in this section describes the main features of the Compact controllers.

Illustrations

The following illustrations are the Compact controllers:

Controller Type	Illustration
The Compact 10 I/O controller: ● has 6 digital inputs and 4 relay outputs ● has 1 analog potentiometer ● has 1 integrated serial port ● accepts one optional cartridge (RTC or memory - 32 KB only) ● accepts an optional operator display module ● accepts 1 ConneXium TwidoPort Ethernet interface module	TWDLCAA10DRF TWDLCDA10DRF 
The Compact 16 I/O controller: ● has 9 digital inputs and 7 relay outputs ● has 1 analog potentiometer ● has 1 integrated serial port ● has a slot for an additional serial port ● accepts one optional cartridge (RTC or memory - 32 KB only) ● accepts an optional operator display module ● accepts 1 ConneXium TwidoPort Ethernet interface module	TWDLCAA16DRF TWDLCDA16DRF 

Controller Type	Illustration
The Compact 24 I/O controller: ● has 14 digital inputs and 10 relay outputs ● has 2 analog potentiometers ● has 1 integrated serial port ● has a slot for an additional serial port ● accepts up to 4 expansion I/O modules ● accepts up to 2 AS-Interface V2 bus interface modules ● accepts 1 CANopen fieldbus interface module ● accepts one optional cartridge (RTC or memory - 32 KB only) ● accepts an optional operator display module ● accepts 1 ConneXium TwidoPort Ethernet interface module	TWDLCAA24DRF TWDLCDA24DRF 

Controller Type	Illustration
The Compact 40 I/O controllers. Features shared by both TWDLCAA40DRF and TWDLCAE40DRF series are as follows: ● has 24 digital inputs, 14 relay and 2 transistor outputs ● has 2 analog potentiometers ● has 1 integrated serial port ● has a slot for an additional serial port ● has RTC onboard ● has battery compartment for user-replaceable external battery ● accepts up to 7 expansion I/O modules ● accepts up to 2 AS-Interface V2 bus interface modules ● accepts 1 CANopen fieldbus interface module ● accepts one optional memory cartridge (32 KB or 64 KB) ● accepts an optional operator display module TWDLCAA40DRF-specific feature: ● accepts 1 ConneXium TwidoPort Ethernet interface module TWDLCAE40DRF-specific feature: ● has 1 built-in Ethernet interface RJ-45 port	TWDLCAA40DRF  TWDLCAE40DRF 

Description of Analog Potentiometers

Introduction

The following section describes the analog potentiometer on the Compact controllers.

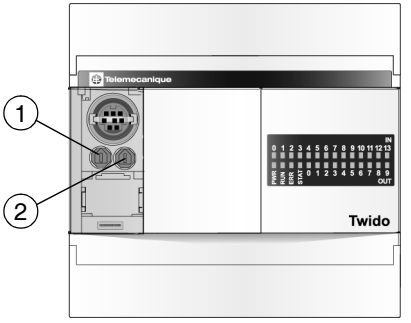
Description

The TWDLC•A10DRF[1] and TWDLC•A16DRF[1] controllers have one analog potentiometer. The TWDLC•A24DRF[1] and TWDLCA•40DRF[2] controllers have two analog potentiometers. The first analog potentiometer can be set to a value between 0 and 1023. The second analog potentiometer can be set to a value between 0 and 511. The value is stored in a system word and is updated in every scan. For more information on setting the analog potentiometer, see the TwidoSoft Software Reference Manual.

Note:
1. • = D as in 24 VDC power supply
• = A as in 110/240 VAC power supply
2. • = A as in standard model (no Ethernet port)
• = E as in built-in Ethernet communications interface

Analog Potentiometer on a Compact Controller

The following figure shows the analog potentiometers on a TWDLC•A24DRF Compact controller.



Legend

Label	Description
1	Analog potentiometer 1
2	Analog potentiometer 2

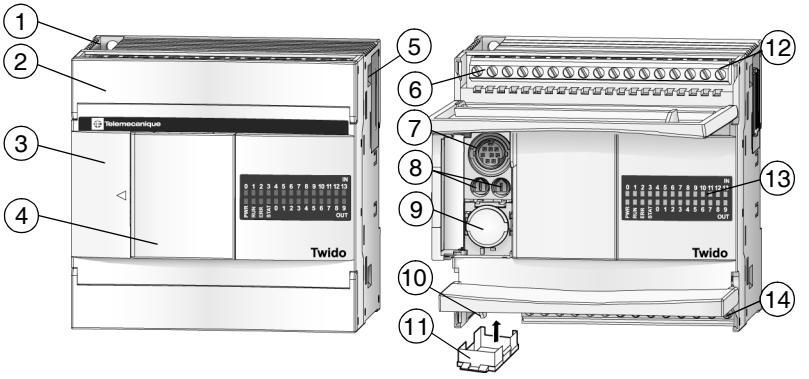
Parts Description of a Compact Controller

Introduction

The following section describes the parts of a Compact controller. Your controller may differ from the illustrations but the parts will be the same.

Parts Description of a Compact Controller

The following figure shows the parts of a Compact controller. This figure is the TWDLCAA24DRF controller.

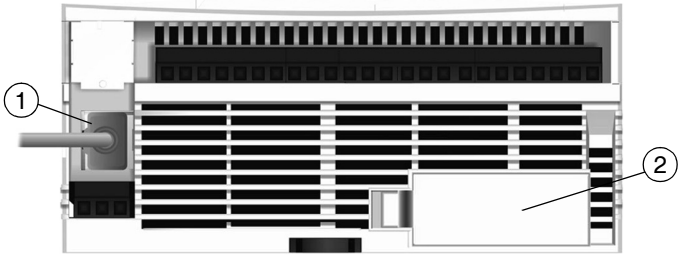


Legend

Label	Description
1	Mounting hole
2	Terminal cover
3	Hinged lid
4	Removable cover to operator display connector
5	Expansion connector - On both 24DRF and 40DRF series compact bases
6	Sensor power terminals
7	Serial port 1
8	Analog potentiometers - TWDLCAA10DRF and TWDLCAA16DRF have one
9	Serial port 2 connector - TWDLCAA10DRF does not have one
10	100-240 VAC power supply terminals on TWDLCA•••DRF series 24 VDC power supply terminals on TWDLCD•••DRF series
11	Cartridge connector - located on the bottom of the controller
12	Input terminals
13	LEDs
14	Output terminals

Rear Panel of a 40DRF Compact Controller

The following figure shows the rear panel of a 40 I/O Compact controller. This figure is the TWDLCAE40DRF controller.



Legend

Label	Description
1	RJ-45 100Base-TX Ethernet port (only TWDLCAE40DRF has one)
2	External user-replaceable battery compartment (both TWDLCAA40DRF and TWDLCAE40DRF have one)

General Specifications for the Compact Controllers

Introduction

This section provides general specifications for the Compact controllers.

Normal Operating Specifications

Compact controller TWDLC...	AA10DRF DA10DRF	AA16DRF DA16DRF	AA24DRF DA24DRF	AA40DRF AE40DRF
Ambient operating temperature	0 to 55°C (32°F to 131°F)			0 to 55°C (32°F to 131°F) at 75% load 0 to 45°C (32°F to 113°F) at full load
Storage temperature	-25°C to +70°C (-13°F to 158°F)			
Relative humidity	Level RH1, 30 to 95% (non-condensing)			
Degree of pollution	2 (IEC60664)			
Degree of protection	IP20			
Corrosion immunity	Free from corrosive gases			
Altitude	Operation: 0 to 2,000 m (0 to 6,560 ft) Transport: 0 to 3,000 m (0 to 9,840 ft)			
Resistance to vibration	When mounted on a DIN rail: 10 to 57 Hz amplitude 0.075 mm, 57 to 150 Hz acceleration 9.8 ms^2 (1G), 2 hours per axis on each of three mutually perpendicular axes. When mounted on a panel surface: 2 to 25 Hz amplitude 1.6 mm, 25 to 100 Hz acceleration 39.2 ms^2 (4G) Lloyd's 90 min per axis on each of three mutually perpendicular axes.			
Impact strength	147 ms^2 (15G), 11 ms duration, 3 shocks per axis, on three mutually perpendicular axes (IEC 61131)			
Weight	230 g (8.11 oz)	250 g (8.81 oz)	305 g (10.75 oz)	522 g (18.4 oz)

Specifications for the Backup Internal Battery

All compact base controllers have one non-removable internal battery

Compact backed up elements	Internal RAM: internal variables, internal bits and words, timers, counters, shift registers, etc.
Time	Approximately 30 days at 25°C (77°F) after battery fully charged.
Battery type	Non-interchangeable lithium accumulator
Charging time	Approximately 15 hours for 0% to 90 % of total load
Service life	10 years

Specifications for the Backup External Battery

Only TWDLCAA40DRF and TWDLCAE40DRF series compact controllers have one external battery compartment.

Compact backed up elements	Internal RAM: internal variables, internal bits and words, timers, counters, shift registers, etc.
Time	Approximately 3 years at 25°C (77°F) under following conditions: ● Internal backup battery is fully charged. ● The Twido compact base is constantly powered. It has had no (or minor) down-time.
Battery type	$^1/_2$ AA, 3.6V, lithium battery Part number TSXPLP01 (Tadiran, TL-5902) Note that the external battery must be purchased separately by user. No external battery is included with the Twido controller's package.

TWDLCA•40DRF Agency Compliance

⚠ WARNING

EMISSION WARNING (5.1.2/CISPR11)

Class A equipment is intended for use in industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.

Failure to follow this instruction can result in death or serious injury.

Electrical Specifications

Compact controller TWDLC...	AA10DRF	AA16DRF	AA24DRF	AA40DRF AE40DRF
Rated power voltage	100 to 240 VAC			
Allowable voltage range	85 to 264 VAC			
Rated power frequency	50/60 Hz (47 to 63 Hz)			
Maximum input current	0.25 A (85 VAC)	0.30 A (85 VAC)	0.45 A (85 VAC)	0.79 A (85 VAC)
Maximum power consumption	30 VA (264 VAC), 20 VA (100 VAC) This controller's power consumption includes 250 mA sensor power.	31 VA (264 VAC), 22 VA (100 VAC) This controller's power consumption includes 250 mA sensor power.	40 VA (264 VAC), 33 VA (100 VAC) This controller plus 4 I/O modules' power consumption includes 250 mA sensor power.	77 VA (264 VAC), 65 VA (100 VAC) This controller plus 7 I/O modules' power consumption includes 400 mA sensor power.
Allowable momentary power interruption	10 ms, 100% drop out (at the rated inputs and outputs) (IEC61131 and IEC61000-4-11)			
Dielectric strength	Between power and ground terminals: 1,500 VAC, 1 min Between I/O and ground terminals: 1,500 VAC, 1 min			
Insulation resistance	Between power and ground terminals: 10 MΩ minimum (500 VDC) Between I/O and ground terminals: 10 MΩ minimum (500 VDC)			
Noise resistance	AC power terminals: 2kV, Level 3 I/O terminals: - DC: 1kV, Level 3 - AC: 2kV, Level 4 According to IEC61131-2 (Zone B) and IEC61000-4-4			
Inrush current	35 A maximum	35 A maximum	40 A maximum	35 A maximum
Ground wiring	UL1007 16 AWG (1.30 mm^2)			
Power supply wiring	UL1015 22 AWG (0.33 mm^2), UL1007 18 AWG (0.82 mm^2)			
Effect of improper power supply connection	Reverse polarity: normal operation Improper voltage or frequency: internal fuse protection			

Compact controller TWDLC...	**DA10DRF**	**DA16DRF**	**DA24DRF**
Rated power voltage	24 VDC		
Allowable voltage range	from 19.2 to 30 VDC (including ripple)		
Maximum input power	Controller	Controller	Controller plus 4 I/O Modules
	3.9 W (@ 24 VDC)	4.6 W (@ 24 VDC)	5.6 W (@ 24 VDC)
Allowable momentary power interruption	10 ms, 100% drop out (at the rated inputs and outputs) (IEC61000-4-11)		
Dielectric strength	Between power and ground terminals: 500 VAC, 1 min Between I/O and ground terminals: 1500 VAC, 1 min		
Insulation resistance	Between power and ground terminals: 10 MΩ minimum (500 VDC) Between I/O and ground terminals: 10 MΩ minimum (500 VDC)		
Noise resistance	AC power terminals: 2kV, Level 3 I/O terminals: - DC: 1kV, Level 3 - AC: 2kV, Level 4 According to IEC61131-2 (Zone B) and IEC61000-4-4		
Inrush current	35 A maximum (@ 24 VDC)	35 A maximum (@ 24 VDC)	40 A maximum (@ 24 VDC)
Ground wiring	UL1015 22 AWG (0.33 mm^2), UL1007 18 AWG (0.82 mm^2)		
Power supply wiring	UL1015 22 AWG (0.33 mm^2), UL1007 18 AWG (0.82 mm^2)		
Effect of improper power supply connection	Reverse polarity: no operation, no damage Improper voltage or frequency: internal fuse protection		

Functional Specifications for the Compact Controllers

Introduction This section provides functional specifications for the Compact controllers.

Communication Function Specifications

Communication Port	Port 1 (RS485)	Port 2 (RS232C) Communication Adapter: TWDNAC232D	Port 2 (RS485) Communication Adapters: TWDNAC485D TWDNAC485T	Ethernet Port (RJ45) (TWDLCAE40DRF controller only)
Standards	RS485	RS232	RS485	100Base-TX, RJ45
Maximum baud rate	PC Link: 19,200 bps Remote Link: 38,400 bps	19,200 bps	PC Link: 19,200 bps Remote Link: 38,400 bps	100 Mbps, depending on network speed.
Modbus communication (RTU master/ slave)	Possible	Possible	Possible	TCP/IP Modbus Client/ Server
ASCII communication	Possible	Possible	Possible	-
Remote communication	7 links possible	Not possible	7 links possible	up to 16 remote nodes configured per controller
Maximum cable length	Maximum distance between the base controller and the remote controller: 200 m (656 ft)	Maximum distance between the base controller and the remote controller: 10 m (32.8 ft)	Maximum distance between the base controller and the remote controller: 200 m (656 ft)	Maximum distance between network nodes (depending on network architecture)
Isolation between internal circuit and communication port	Not isolated	Not isolated	Not isolated	Isolated
Telephone communication	Possible Possible to connect from a receive only modem.	Not possible	Not possible	Not possible

Built-in Function Specifications

Sensor power supply	Output voltage/current	24 VDC (+10% to -15%), 250 mA max. current (For TWDLCA•40DRF, 400 mA max. current)
	Overload detection	Short-circuit protection for TWDLCA•40DRF. Not available on all other controllers.
	Isolation	Isolated from the internal circuit
Counting	Number of channels	4
	Frequency	For TWDLCA•40DRF: - 4 channels at 5kHz (FCi), - 2 channels at 20kHz (VFCi) For all other controllers: - 3 channels at 5kHz (FCi), - 1 channel at 20kHz (VFCi)
	Capacity	16 bits (0..65535 steps) 32 bits (0..4294967295 steps)
Analog potentiometers	1 adjustable from 0 through to 1023 steps	
	1 adjustable from 0 through to 511 steps	
FCi: Fast Counter "i". **VFCi: Very Fast Counter "i".**		

I/O Specifications for the Compact Controller

Introduction

This section provides I/O specifications for the Compact controllers.

DC Input Specifications

> **⚠ WARNING**
>
> **HAZARDS OF UNINTENDED EQUIPMENT OPERATION & EQUIPMENT DAMAGE**
>
> If any input exceeding the rated value is applied, permanent damage may be caused.
>
> **Failure to follow this instruction can result in death, serious injury, or equipment damage.**

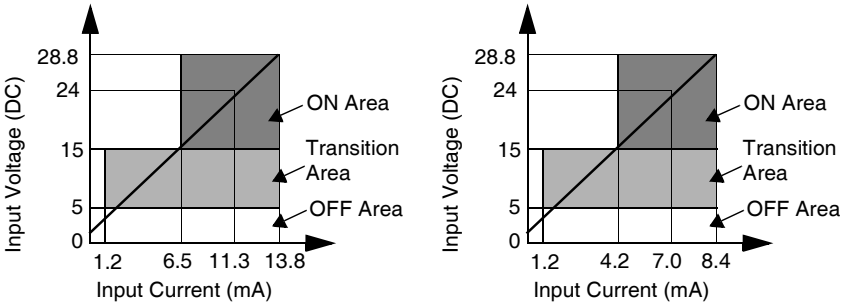
Compact controller	**TWDLCAA10DRF TWDLCDA10DRF**	**TWDLCAA16DRF TWDLCDA16DRF**	**TWDLCAA24DRF TWDLCDA24DRF**	**TWDLCAA40DRF TWDLCAE40DRF**
Input points	6 points in 1 common line	9 points in 1 common line	14 points in 1 common line	24 points in 2 common lines
Rated input voltage	24 VDC sink/source input signal			
Input voltage range	from 20.4 to 28.8 VDC			
Rated input current	I0 and I1: 11 mA I2 to I13: 7 mA/point (24 VDC)			I0, I1, I6, I7: 11 mA I2 to I5, I8 to I23: 7 mA/point (24 VDC)
Input impedance	I0 and I1: 2.1 kΩ I2 to I13: 3.4 kΩ			I0, I1, I6, I7: 2.1 kΩ I2 to I5, I8 to I23: 3.4 kΩ
Turn on time	I0 to I1: 35 µs + filter value I2 to I13: 40 µs + filter value			I0, I1, I6, I7: 35 µs + filter value I2 to I5, I8 to I23: 40 µs + filter value
Turn off time	I0 and I1: 45 µs + filter value I2 to I13: 150 µs + filter value			I0, I1, I6, I7: 45 µs + filter value I2 to I5, I8 to I23: 150 µs + filter value
Isolation	Between input terminals and internal circuit: photocoupler isolated (isolation protection up to 500 V) Between input terminals: not isolated			
Input type	Type 1 (IEC 61131)			

Compact controller	TWDLCAA10DRF TWDLCDA10DRF	TWDLCAA16DRF TWDLCDA16DRF	TWDLCAA24DRF TWDLCDA24DRF	TWDLCAA40DRF TWDLCAE40DRF
External load for I/O interconnection	Not needed			
Signal determination method	Static			
Input signals type	The input signals can be both sink and source.			
Cable length	3m (9.84 ft) for compliance with electromagnetic immunity.			

Input Operating Range

The input operating range of the Type 1 (IEC 61131-2) input module is shown below.

Inputs I0 and I1 <- (10, 16 and 24 I/O controllers) -> Inputs I0, I1, I6, I7
Inputs I0, I1, I6, I7 <- (40 I/O controllers) -> Inputs I2 to I5, I8 to I23



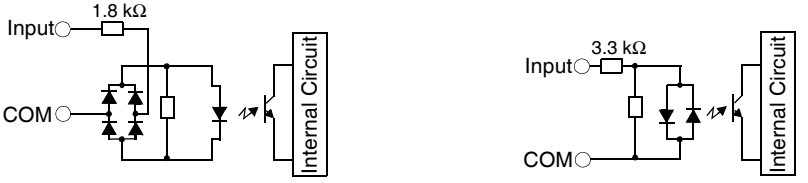
Input Internal Circuit

The input internal circuit is shown below.

Latching or High Speed Sink or Source Inputs

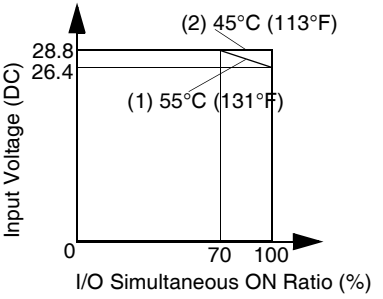
Standard Sink or Source Input

Inputs I0 and I1 <- (10, 16 and 24 I/O controllers) -> Inputs I0, I1, I6, I7
Inputs I0, I1, I6, I7 <- (40 I/O controllers) -> Inputs I2 to I5, I8 to I23



I/O Usage Limits

When using TWDLC•AA16DRF, TWDLC•A24DRF and TWDLCA•40DRF at an ambient temperature of 55°C (131°F) in the normal mounting direction, limit the inputs and outputs, respectively, which turn on simultaneously along line (1).



Also, when using the above-mentionned controllers at 45°C (113°F), all I/O can be turned on simultaneously at input voltage 28.8 VDC as indicated with line (2).
When using the TWDDMM8DRT controller, all inputs and outputs can be turned on simultaneously at 55°C (131°F), input voltage 28.8 VDC.
For other possible mounting directions, see *Controller, Expansion I/O Module, AS-Interface Bus Master Module and CANopen Fieldbus Master Module Mounting Positions, p. 207*.

Relay Output Specifications

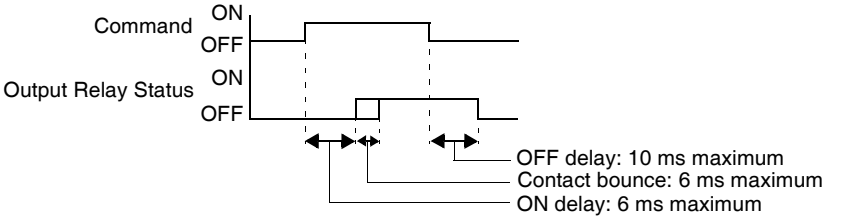
Compact controller	TWDLCAA10DRF TWDLCDA10DRF	TWDLCAA16DRF TWDLCDA16DRF	TWDLCAA24DRF TWDLCDA24DRF	TWDLCAA40DRF TWDLCDAE40DRF
Output points	4 output	7 output	10 output	14 output
Output points per common line: COM0	3 NO contacts	4 Normally Open	4 NO contacts	—
Output points per common line: COM1	1 NO contact	2 NO contacts	4 NO contacts	—
Output points per common line: COM2	—	1 NO contact	1 NO contact	4 NO contact
Output points per common line: COM3	—	—	1 NO contact	4 NO contact
Output points per common line: COM4	—	—	—	4 NO contact
Output points per common line: COM5	—	—	—	1 NO contact
Output points per common line: COM6	—	—	—	1 NO contact
Maximum load current	2 A per output 8 A per common line			
Minimum switching load	0.1 mA/0.1 VDC (reference value)			
Initial contact resistance	30 mΩ maximum: @ 240VAC/2A load (TWDLCA•... controllers) @ 30VDC/2A load (TWDLCD•... controllers)			
Electrical life	100,000 operations minimum (rated resistive load 1,800 operations/h)			
Mechanical life	20,000,000 operations minimum (no load 18,000 operations/h)			
Rated load (resistive/inductive)	240 VAC/2 A, 30 VDC/2 A			
Dielectric strength	Between output to internal circuit: 1500 VAC, 1 min Between output groups: 1500 VAC, 1 min			

Transistor Source Output Specifications

Compact controller	TWDLCAA40DRF and TWDLCAE40DRF
Output type	Source output
Number of digital output points	2
Output points per common Line	1
Rated load voltage	24 VDC
Maximum load current	1 A per common line
Operating load voltage range	from 20.4 to 28.8 VDC
Voltage drop (on voltage)	1 V maximum (voltage between COM and output terminals when output is on)
Rated load current	1 A per output
Inrush current	2.5 A maximum
Leakage current	0.25 mA maximum
Maximum lamp load	19 W
Inductive load	L/R = 10 ms (28.8 VDC, 1 Hz)
External current draw	12 mA maximum, 24 VDC (power voltage at the +V terminal)
Isolation	Between output terminal and internal circuit: photocoupler isolated (isolation protection up to 500 VDC) Between output terminals: 500 VDC
Output delay - turn on/off time	Q0, Q1: 5 µs maximum ($I \geq 5mA$)

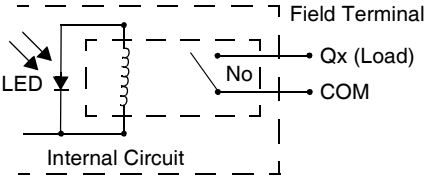
Output delay

The output delay is shown below.



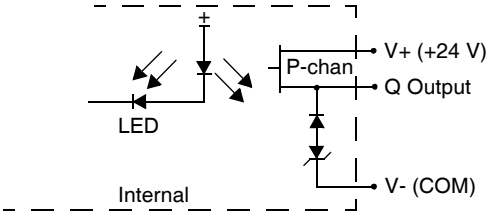
Relay Output Contact

The relay output contact is shown below.



Transistor Source Output Contact

The transistor source output contact applicable to TWDLCA•40DRF series compact controllers is shown below.



Compact Controller Wiring Schematics

Introduction

This section shows examples of wiring schematics for Compact controllers.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK

- Be sure to remove ALL power from ALL devices before connecting or disconnecting inputs or outputs to any terminal or installing or removing any hardware.
- Be sure to connect the grounding wire to a proper ground.

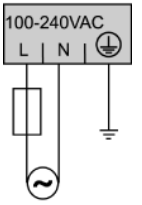
Failure to follow this instruction will result in death, serious injury, or equipment damage.

Note: These schematics are for external wiring only.

Note: The shaded boxes are markings on the controller. The I and Q numbers are the input and output points.

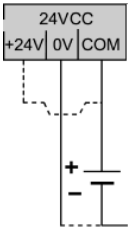
AC Power Supply Wiring Schematic

The following AC power supply wiring schematic is for the TWDLCA•••DRF series controllers.



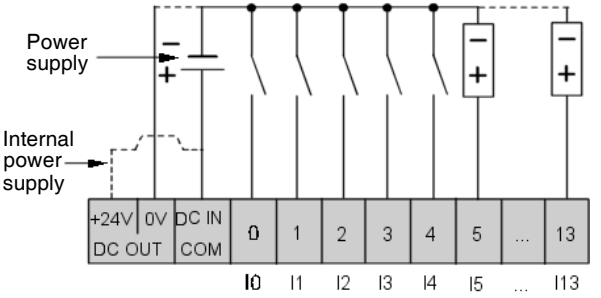
DC Power Supply Wiring Schematic

The following DC power supply wiring schematic is for the TWDLCDA••DRF series controllers. (Note that TWDLCA•40DRF series controllers have AC power supply only.)

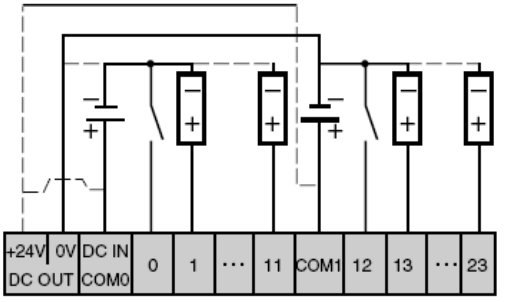


DC Source Input Wiring Schematic

The following schematic is for the TWDLC•A10DRF, TWDLC•A16DRF, and TWDLC•A24DRF controllers.

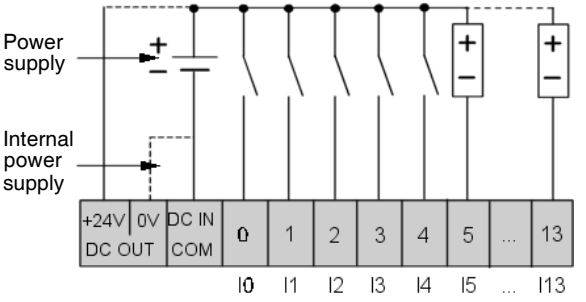


The following DC source input wiring schematic is for the TWDLCA•40DRF series controllers.

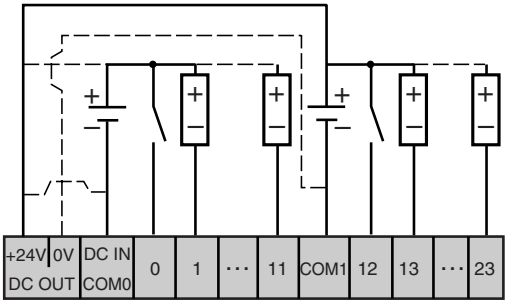


DC Sink Input Wiring Schematic

This schematic is for the TWDLC•A10DRF, TWDLC•A16DRF, and TWDLC•A24DRF controllers.

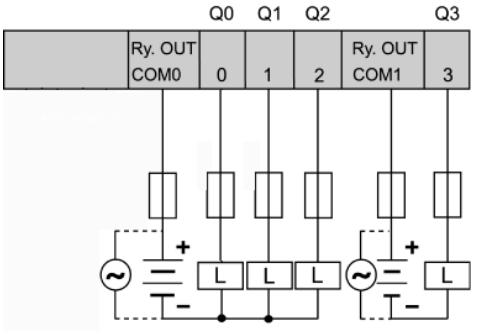


The following DC sink input wiring schematic is for the TWDLCA•40DRF series controllers.

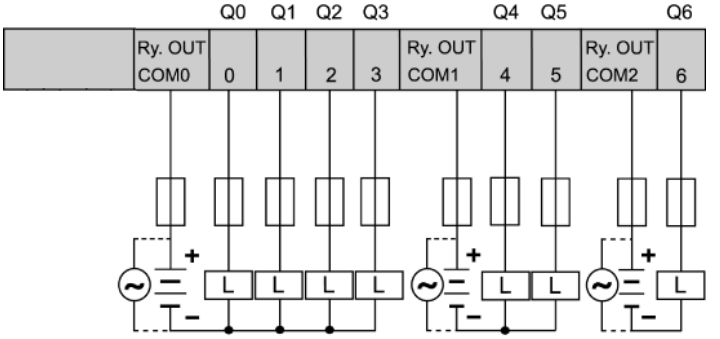


Relay and Transistor Output Wiring Schematic

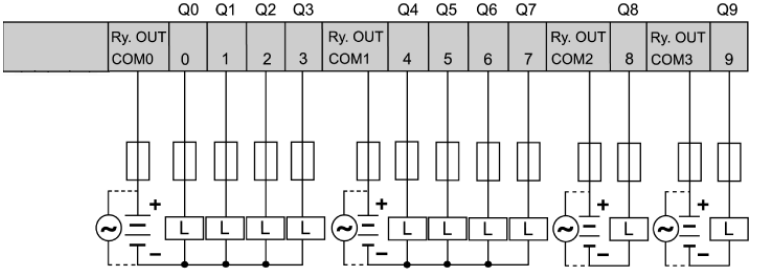
This schematic is for the TWDLC•A10DRF series controllers.



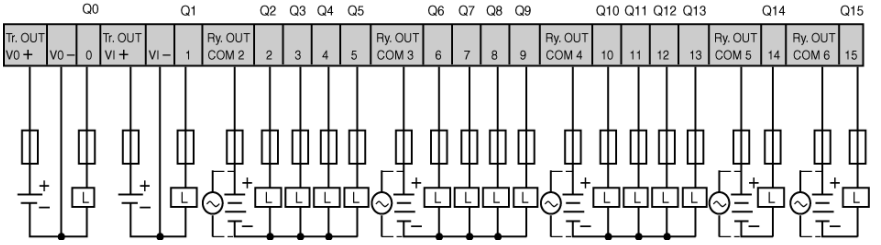
This schematic is for the TWDLC•A16DRF series controllers.



This schematic is for the TWDLC•A24DRF series controllers.



This schematic is for the TWDLCA•40DRF series controllers.



Reverse-Polarity at Transistor Output is Not Allowed
The TWDLCA•40DRF compact bases transistor outputs cannot withstand any reverse polarity.

⚠ CAUTION

RISK OF REVERSE-POLARITY DAMAGE AT TRANSISTOR OUTPUTS

- Make sure to conform to the polarity markings on the transistor output terminals.
- Use of a reverse polarity can permanently damage or destroy the output circuits.

Failure to follow this instruction can result in injury or equipment damage.

2.3 Modular Controller

At a Glance

Introduction

This section provides an overview, parts description, specifications, and wiring schematics of the Modular controllers.

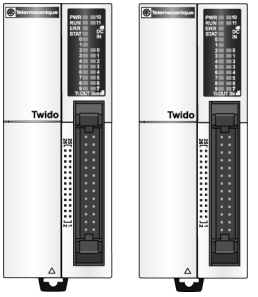
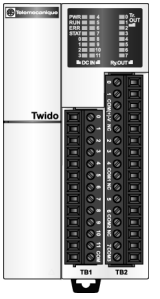
What's in this Section?

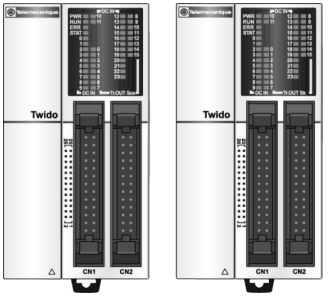
This section contains the following topics:

Overview of Modular Controllers

Introduction The following section provides an overview of the Modular controllers.

Illustrations The following illustrations are the Modular controllers.

Controller Type	Illustration
The Modular 20 I/O controllers: ● are available in two models: with transistor source outputs (TWDLMDA20DTK) or with transistor sink outputs (TWDLMDA20DUK) ● have 12 digital inputs and 8 transistor source or sink outputs ● have 1 analog voltage input connector ● have 1 analog potentiometer ● have 1 integrated serial port ● have a connector for wiring ● accept up to 4 expansion I/O modules ● accept up to 2 AS-Interface V2 bus interface modules ● accept 1 CANopen fieldbus interface module ● accept both optional cartridges (RTC and memory - 32 KB or 64 KB) ● accept either an optional operator display expansion module or an optional communication expansion module ● accept 1 ConneXium TwidoPort Ethernet interface module	TWDLMDA20DTK TWDLMDA20DUK 
The Modular 20 I/O controller: ● has 12 digital inputs, 6 relay outputs, and 2 transistor source outputs ● has 1 analog voltage input connector ● has 1 analog potentiometer ● has 1 integrated serial port ● has a terminal block for wiring ● accepts up to 7 expansion I/O modules ● accepts up to 2 AS-Interface V2 bus interface modules ● accepts 1 CANopen fieldbus interface module ● accepts both optional cartridges (RTC and memory - 32 KB or 64 KB) ● accepts either an optional operator display expansion module or an optional communication expansion module ● accept 1 ConneXium TwidoPort Ethernet interface module	TWDLMDA20DRT 

Controller Type	Illustration
The Modular 40 I/O controller: ● is available in two models: with transistor source outputs (TWDLMDA40DTK) or with transistor sink outputs (TWDLMDA40DUK) ● has 24 digital inputs and 16 transistor source or sink outputs ● has 1 analog voltage input connector ● has 1 analog potentiometer ● has 1 integrated serial port ● has a connector for wiring ● accepts up to 7 expansion I/O modules ● accepts up to 2 AS-Interface V2 bus interface modules ● accept 1 CANopen fieldbus interface module ● accepts both optional cartridges (RTC and memory - 32 KB or 64 KB) ● accepts either an optional operator display expansion module or an optional communication expansion module ● accept 1 ConneXium TwidoPort Ethernet interface module	TWDLMDA40DTK TWDLMDA40DUK 

Description of Analog Potentiometers

Introduction

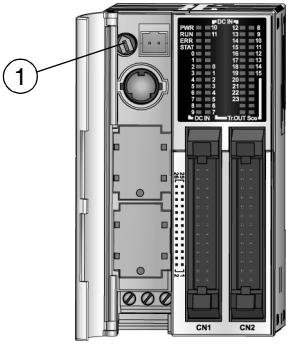
The following section describes the analog potentiometer on the Modular controllers.

Description

The TWDLMDA20DUK, TWDLMADA20DTK, TWDLMDA20DRT, TWDLMDA40DUK, and TWDLMADA40DTK controllers have one analog potentiometer. The analog potentiometer can be set to a value between 0 and 1024. The value is stored in a system words and is updated in every scan. For more information on setting the analog potentiometer, see the TwidoSoft Software Reference Manual.

Analog Potentiometer on a Compact Controller

The following figure shows the analog potentiometer on a Modular controller, the TWDLMDA40DUK.



Legend

Label	Description
1	Analog potentiometer 1

Overview of Analog Voltage Input

Introduction

The following section describes the analog voltage input on the Modular controllers.

Description

All Modular controllers have one analog voltage input. The analog voltage input connects an analog voltage source of 0 through 10 VDC. The analog voltage is converted to a value of 0 through 512 and is stored in a system word.

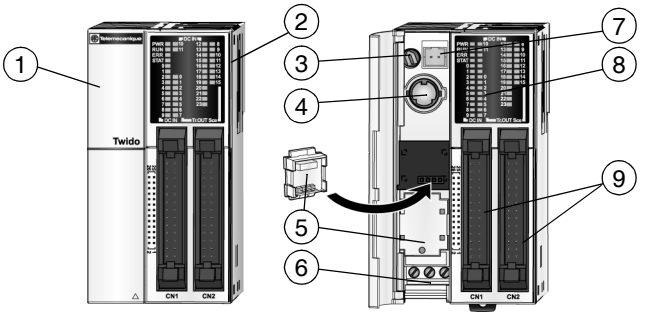
Parts Description of a Modular Controller

Introduction

The following section describes the parts of a Modular controller. Your controller may differ from the illustrations but the parts will be the same.

Parts Description of a Modular Controller

The following figure shows the parts of a Modular controller. This figure is the Modular 40 I/O controller.



Legend

Label	Description
1	Hinged lid
2	Expansion connector
3	Analog potentiometer
4	Serial port 1
5	Cartridge covers
6	24 VDC power supply terminals
7	Analog voltage input connector
8	LEDs
9	I/O terminals
10	Communication connector

General Specifications for the Modular Controllers

Introduction

This section provides general specifications for the Modular controllers.

Normal Operating Specifications

Modular controller	TWDLMDA20DTK TWDLMDA20DUK	TWDLMDA20DRT	TWDLMDA40DTK TWDLMDA40DUK
Operating temperature	0 to 55°C (32°F to 131°F) operating ambient temperature		
Storage temperature	-25°C to +70°C (-13°F to 158°F)		
Relative humidity	from 30 to 95% Rh (non-condensing)		
Pollution degree	2 (IEC60664)		
Degree of protection	IP20		
Corrosion immunity	Free from corrosive gases		
Altitude	Operation: from 0 to 2000 m (0 to 6,560 ft) Transport: 0 to 3,000 m (0 to 9,840 ft)		
Resistance to Vibration	When mounted on a DIN rail: from 10 to 57 Hz amplitude 0.075 mm, from 57 to 150 Hz acceleration 9.8 ms^2 (1G), 2 hours per axis on each of three mutually perpendicular axes. When mounted on a panel surface: from 2 to 25 Hz amplitude 1.6 mm, from 25 to 100 Hz acceleration 39.2 ms^2 (4G) Lloyd's 90 min per axis on each of three mutually perpendicular axes.		
Impact strength	147 ms^2 (15G), 11 ms duration, 3 shocks per axis, on three mutually perpendicular axes (IEC 61131).		
Weight	140 g (4.93 oz)	185 g (6.52 oz)	180 g (6.35 oz)

Specifications for the Backup Battery

Modular backed up elements	**Internal RAM: internal variables, internal bits and words, timers, counters, shift registers, etc.**
Time	Approximately 30 days at 25°C (77°F) after battery fully charged.
Battery type	Non-interchangeable lithium accumulator
Charging time	Approximately 15 hours for 0% to 90 % of total load
Service life	10 years

Electrical Specifications

Modular controller	**TWDLMDA20DTK TWDLMDA20DUK**	**TWDLMDA20DRT**	**TWDLMDA40DTK TWDLMDA40DUK**
Rated power voltage	24 VDC		
Allowable voltage range	from 20.4 to 26.4 VDC (including ripple)		
Maximum input power	Controller plus 4 I/O Modules	Controller plus 7 I/O Modules	
	15 W (26.4 VDC)	19 W (26.4 VDC)	19 W (26.4 VDC)
Allowable momentary power interruption	10 ms, 100% drop out (at the rated inputs and outputs) (IEC61131 and IEC61000-4-11)		
Dielectric strength	Between power and ground terminals: 500 VAC, 1 min Between I/O and ground terminals: 1500 VAC, 1 min		
Insulation resistance	Between power and ground terminals: 10 MΩ minimum (500 VDC) Between I/O and ground terminals: 10 MΩ minimum (500 VDC)		
Noise resistance	AC power terminals: 2kV, Level 3 I/O terminals: - DC: 1kV, Level 3 - AC: 2kV, Level 4 According to IEC61131-2 (Zone B) and IEC61000-4-4		
Inrush current	50 A maximum (24 VDC)		
Ground wiring	UL1015 22 AWG (0.33 mm^2), UL1007 18 AWG (0.82 mm^2)		
Power supply wiring	UL1015 22 AWG (0.33 mm^2), UL1007 18 AWG (0.82 mm^2)		
Effect of improper power supply connection	Reverse polarity: no operation, no damage Improper voltage or frequency: internal fuse protection		

Functional Specifications for the Modular Controllers

Introduction This section provides functional specifications for the Modular controllers.

Communication Function Specifications

Communication Port	Port 1 (RS485)	Port 2 (RS232C) Communication Expansion Module (TWDNOZ232D) or Operator Display Expansion Module (TWDXCPODM) with Communication Adapter (TWDNAC232D)	Port 2 (RS485) Communication Expansion Modules (TWDNOZ485D) or (TWDNOZ485T) or Operator Display Expansion Module (TWDXCPODM) with Communication Adapter (TWDNAC485D) or (TWDNAC485T)
Standards	RS485	RS232	RS485
Maximum baud rate	PC Link: 19,200 bps Remote Link: 38,400 bps	19,200 bps	PC Link: 19,200 bps Remote Link: 38,400 bps
Modbus communication (RTU master/slave)	Possible	Possible	Possible
ASCII communication	Possible	Possible	Possible
Remote communication	7 links possible	Not possible	7 links possible
Maximum cable length	Maximum distance between the base controller and the remote controller: 200 m (656 ft)	Maximum distance between the base controller and the remote controller: 200 m (656 ft)	Maximum distance between the base controller and the remote controller: 200 m (656 ft)
Isolation between internal circuit and communication port	Not isolated	Not isolated	Not isolated
Telephone communication	Possible Possible to connect from a receive only modem.	Not possible	Not possible

Built-in Function Specifications

Analog voltage input	Number of channels	1
	Input voltage range	from 0 to 10 VDC
	Input impedance	100 kΩ
	Resolution	9 bits (0 to 511 pulses)
	Input error	+/- 5%
	Sample duration time	5 ms
	Sample repeat time	5 ms
	Total input transfer time	5 ms + 1 cycle time
Movement	Number of channels	2
	Frequency	7 kHz
	Functions	PWM - Pulse Width Modulation output PLS - Pulse generator output
Counting	Number of channels	4
	Frequency	2 channels at 5kHz (FCi), 2 channels at 20kHz (VFCi)
	Capacity	16 bits (0..65535 steps)
Analog potentiometers	1 adjustable from 0 through to 1023 steps	
FCi = Fast Counter "i" **VFCi = Very Fast Counter "i"**		

I/O Specifications for the Modular Controllers

Introduction

This section provides I/O specifications for the Modular controllers.

DC Input Specifications

⚠ WARNING

HAZARDS OF UNINTENDED EQUIPMENT OPERATION & EQUIPMENT DAMAGE

If any input exceeding the rated value is applied, permanent damage may be caused.

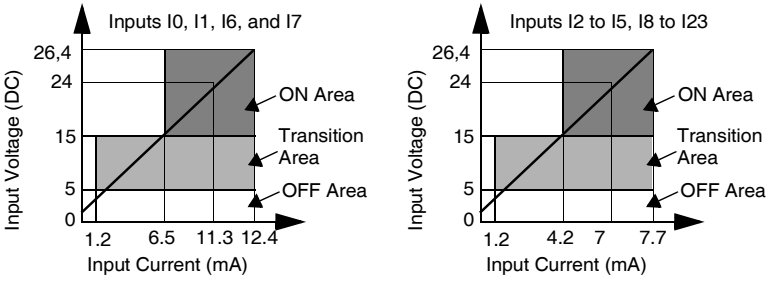
Failure to follow this instruction can result in death, serious injury, or equipment damage.

Modular controller	**TWDLMDA20DUK TWDLMDA20DTK**	**TWDLMDA20DRT**	**TWDLMDA40DUK TWDLMDA40DTK**
Input points	12 points in 1 common line	12 points in 1 common line	24 points in 1 common line
Rated input voltage	24 VDC source/sink input signal		
Input voltage range	from 20.4 to 26.4 VDC		
Rated input current	I0, I1, I6, I7: 5 mA/input (24 VDC) I2 to I5, I8 to I23: 7 mA/input (24 VDC)		
Input impedance	I0, I1, I6, I7: 5.7 kΩ I2 to I5, I8 to I23: 3.4 kΩ		
Turn on time (ON Time)	I0 to I7: 35 µs + filter value I8 to I23: 40 µs + filter value		
Turn off time (OFF Time)	I0, I1, I6, I7: 45 µs + filter value I2 to I5, I8 to I23: 150 µs + filter value		
Isolation	Between input terminals and internal circuit: photocoupler isolated (isolation protection up to 500 V) Between input terminals: not isolated		
Filtering (3 possibilities: none, 3 ms or 12 ms.)	I0 to I11	I0 to I11	I0 to I7
Input type	Type 1 (IEC 61131)		
External load for I/O interconnection	Not needed		
Signal determination method	Static		
Input signals type	The input signals can be both sink and source.		

Modular controller	TWDLMDA20DUK TWDLMDA20DTK	TWDLMDA20DRT	TWDLMDA40DUK TWDLMDA40DTK
Cable length	3m (9.84 ft) for compliance with electromagnetic immunity		
Connector insertion/ removal durability	100 times minimum		

Input Operating Range

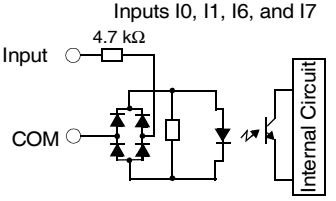
The input operating range of the Type 1 (IEC 61131-2) input module is shown below.



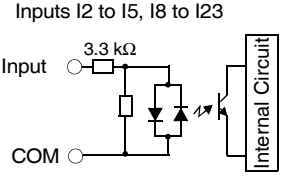
Input Internal Circuit

The input internal circuit is shown below.

Latching or High Speed Sink or Source Inputs

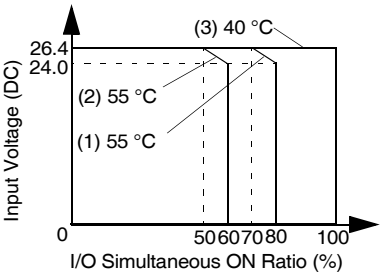


Standard Sink Or Source Input



I/O Usage Limits

When using TWDLMDA20DUK and TWDLMDA20DTK at an ambient temperature of 55°C (131°F) in the normal mounting direction, limit the inputs and outputs, respectively, which turn on simultaneously along line (1).



When using TWDLMDA40DUK and TWDLMDA40DTK limit the inputs and outputs, respectively, which turn on simultaneously along line (2).
At 40°C (104°F), all inputs and outputs can be turned on simultaneously at 26.4 VDC as indicated with line (3).
When using the TWDLMDA20DRT controller, all inputs and outputs can be turned on simultaneously at 55°C (131°F), input voltage 26.4 VDC.

Transistor Sink and Source Output Specifications

Modular controller TWDLMDA...	20DUK	40DUK	20DRT	20DTK	40DTK
Output type	Sink output	Sink output	Source output	Source output	Source output
Output points per common Line	8	2	2	8	16
Rated load voltage	24 VDC				
Maximum load current	1 A per common line				
Operating load voltage range	from 20.4 to 28.8 VDC				
Voltage drop (on voltage)	1 V maximum (voltage between COM and output terminals when output is on)				
Rated load current	0.3 A per output				
Inrush current	1 A maximum				
Leakage current	0.1 mA maximum				
Clamping voltage	39 V +/-1 V				
Maximum lamp load	8 W				
Inductive load	L/R = 10 ms (28.8 VDC, 1 Hz)				
External current draw	100 mA maximum, 24 VDC (power voltage at the +V terminal)		100 mA maximum, 24 VDC (power voltage at the -V terminal)		
Isolation	Between output terminal and internal circuit: photocoupler isolated (isolation protection up to 500 V) Between output terminals: not isolated				
Average number of connector insertions/removals	100 times minimum				
Output delay - turn on time	Q0, Q1: 5 µs maximum Q2 to Q15: 300 µs maximum				
Output delay - turn off time	Q0, Q1: 5 µs maximum Q2 to Q15: 300 µs maximum				

Relay Output Specifications

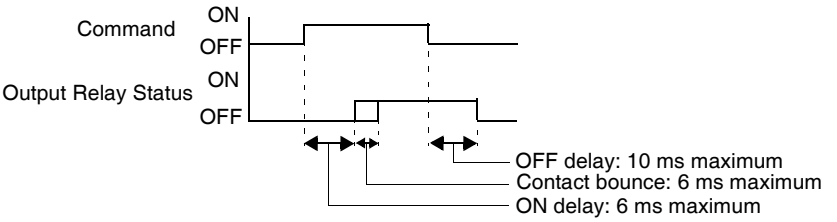
Modular controller	TWDLMDA20DRT
Number of outputs	8 digital inputs consisting of 6 relay outputs and 2 transistor source outputs
Output points per common line - COM0	2 outputs
Output points per common line - COM1	3 NO contacts
Output points per common line - COM2	2 NO contacts
Output points per common line - COM3	1 NO contact
Maximum load current	2 A per output 8 A per common line
Minimum switching load	0.1 mA/0.1 VDC (reference value)
Initial contact resistance	30 mΩ maximum
Mechanical life	20,000,000 operations minimum (no load 18,000 operations/h)
Dielectric strength	Between output to internal circuit: 1500 VAC, 1 min Between output groups: 1500 VAC, 1 min
Connector insertion/removal durability	100 times minimum

Usage category	Rated load	Electrical life (number of operations)
AC1 Resistive load command	500 VA(*)	10^5
AC14 Weak solenoid load	250 VA	10^5
AC15 Solenoid	200 VA	10^5
DC1 Resistive load command	60 W(*)	10^5
DC13 Solenoid L/R=150ms	30 W	10^5

(*) for AC1 & DC1 the outputs indicated here take the maximum per point on Twido (2A) into account.

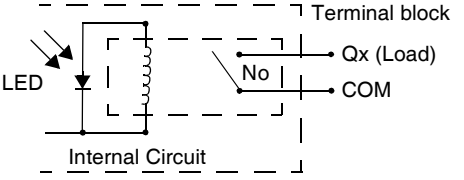
Output delay

The output delay is shown below.



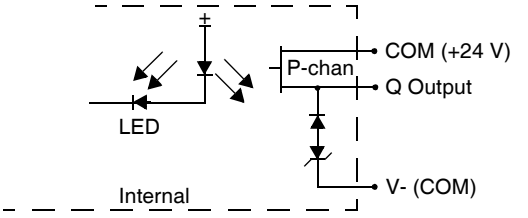
Relay Output Contact

The relay output contact is shown below.



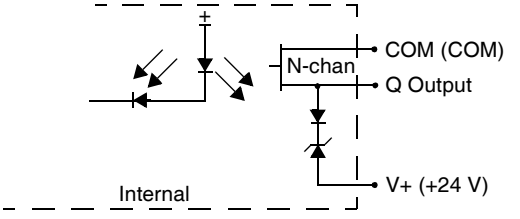
Transistor Source Output Contact

The transistor source output contact is shown below.



Transistor Sink Output Contact

The transistor sink output contact is shown below.



Modular Controller Wiring Schematics

Introduction

This section shows examples of wiring schematics for the Modular controllers.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK

- Be sure to remove ALL power from ALL devices before connecting or disconnecting inputs or outputs to any terminal or installing or removing any hardware.
- Be sure to connect the grounding wire to a proper ground.

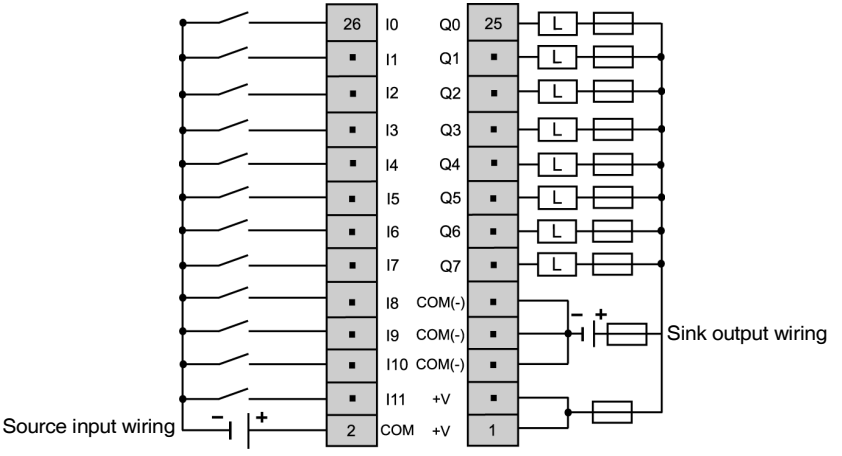
Failure to follow this instruction will result in death, serious injury, or equipment damage.

Note: These schematics are for external wiring only.

Note: The shaded boxes are markings on the controller. The I and Q numbers are the input and output points.

TWDLMDA20-DUK Wiring Schematic

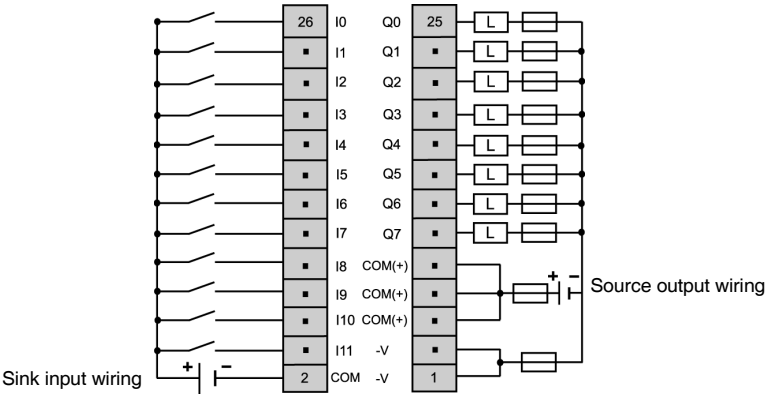
This schematic is for the TWDLMDA20DUK controller with connector.



- The COM(-) terminals are connected together internally.
- The COM and COM(-) terminals are **not** connected together internally.
- The +V terminals are connected together internally.
- Connect an appropriate fuse for the load.

TWDLMDA20-DTK Wiring Schematic

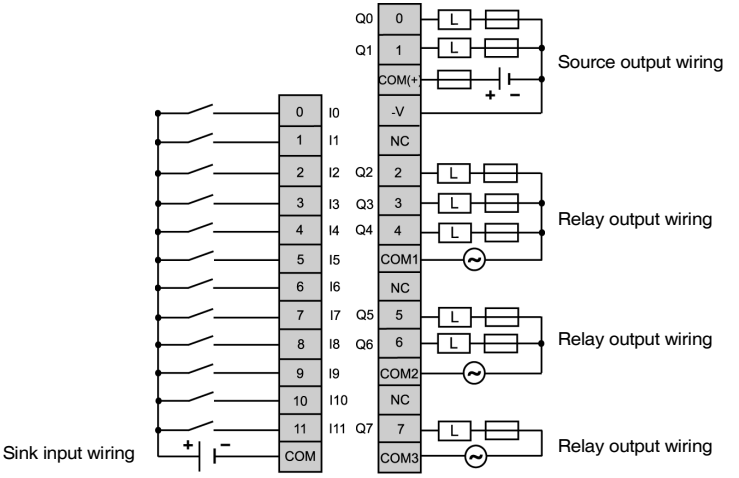
This schematic is for the TWDLMDA20DTK controller with connector.



- The COM(+) terminals are connected together internally.
- The COM and COM(+) terminals are **not** connected together internally.
- The -V terminals are connected together internally.
- Connect an appropriate fuse for the load.

TWDLMDA20-DRT Wiring Schematic

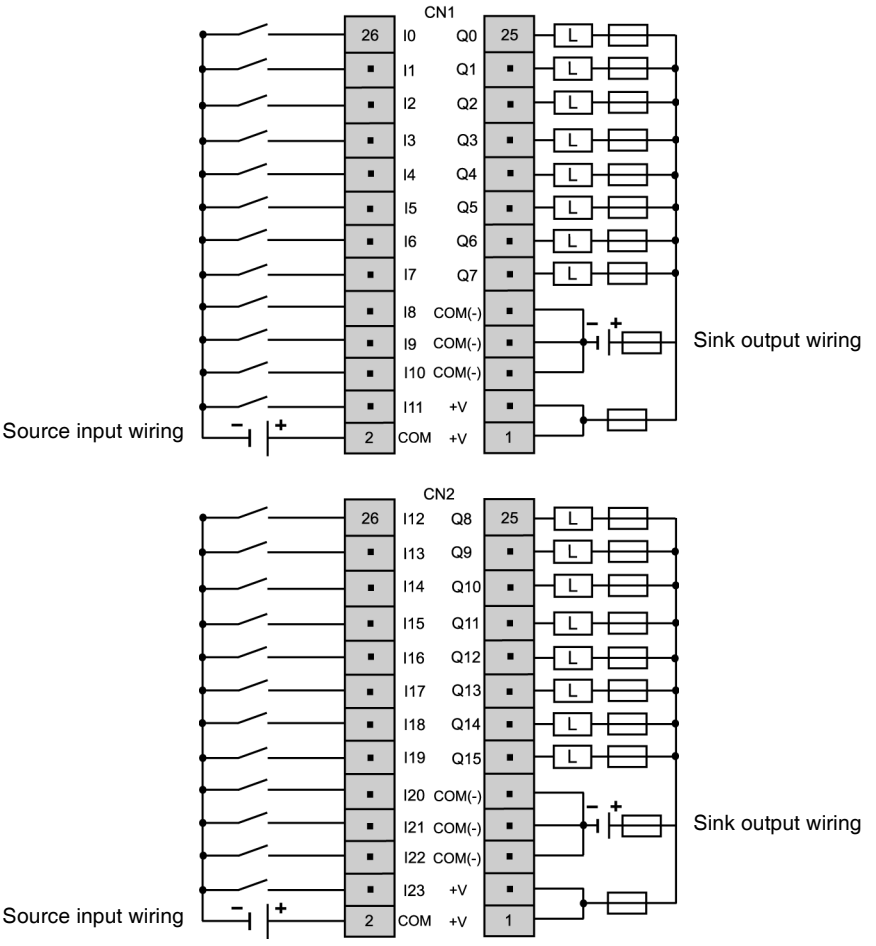
This schematic is for the TWDLMDA20DRT controller with terminal block.



- Output points 0 and 1 are transistor source outputs, all other output points are relay.
- The COM terminals are **not** connected together internally.
- Connect an appropriate fuse for the load.

TWDLMDA40-DUK Wiring Schematic

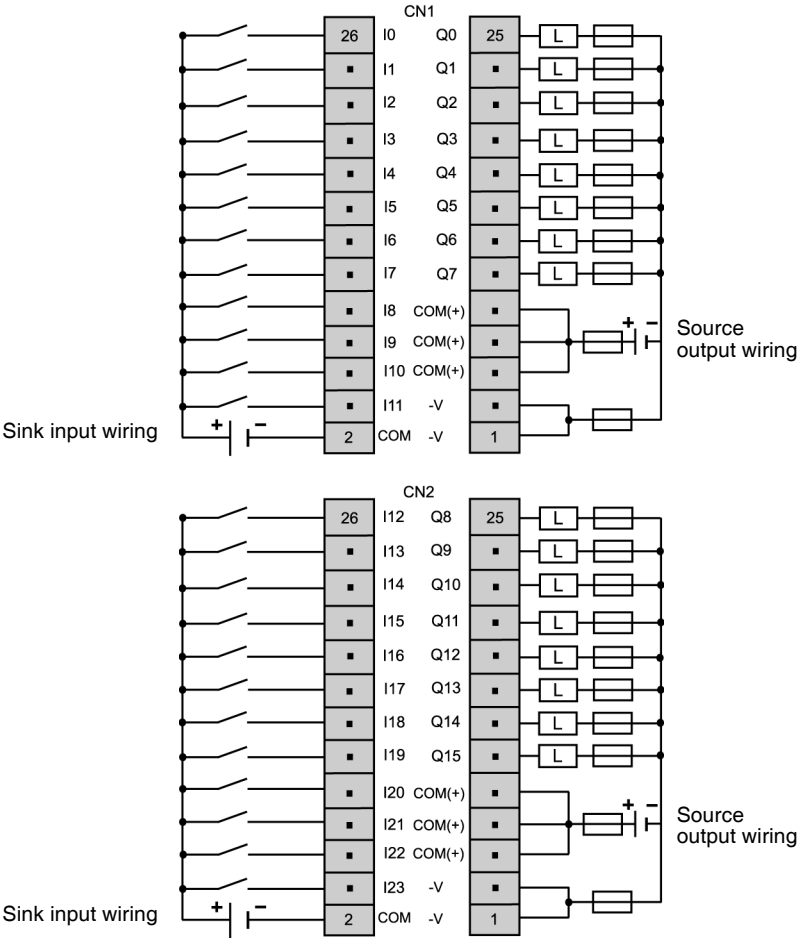
This schematic is for the TWDLMDA40DUK controller with connector.



- The terminals on CN1 and CN2 are **not** connected together internally.
- The COM(-) terminals are connected together internally.
- The COM and COM(-) terminals are **not** connected together internally.
- The +V terminals are connected together internally.
- Connect an appropriate fuse for the load.

TWDLMDA40-DTK Wiring Schematic

This schematic is for the TWDLMDA40DTK controller with connector.



- The terminals on CN1 and CN2 are **not** connected together internally.
- The COM(+) terminals are connected together internally.
- The COM and COM(+) terminals are **not** connected together internally.
- The -V terminals are connected together internally.
- Connect an appropriate fuse for the load.

2.4 Digital I/O Modules

At a Glance

Introduction

This section provides an overview, specifications, and wiring schematics of the digital I/O modules.

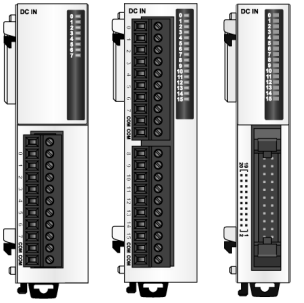
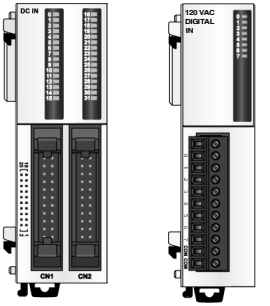
What's in this Section?

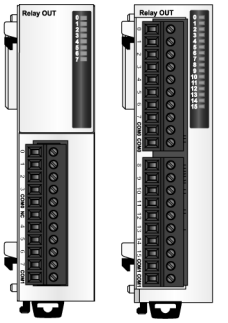
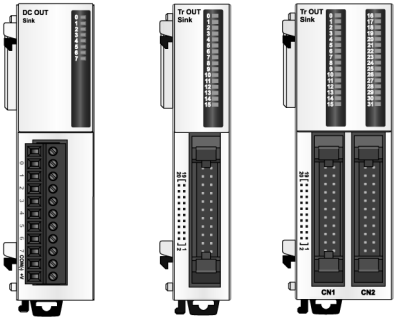
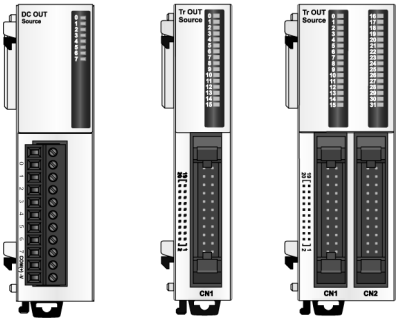
This section contains the following topics:

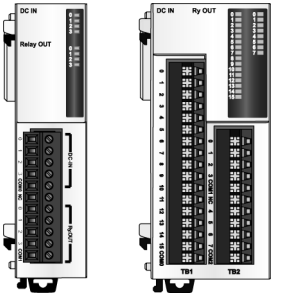
Overview of Digital I/O Modules

Introduction The following section provides an overview of the digital I/O modules.

Illustrations The following illustrations are the digital input, output, and mixed I/O modules.

Model Type	Illustration
There are 4 digital input modules: • 8-point module with a terminal block (TWDDDI8DT) • 16-point module with a terminal block (TWDDDI16DT) • 16-point module with a connector (TWDDDI16DK) • 32-point module with a connector (TWDDDI32DK) • 8-point, 120 VAC input module with a terminal block (TWDDAI8DT) These modules can be attached to any controller except the Compact 10 I/O and 16 I/O controllers.	TWDDDI8DT TWDDDI16DK TWDDDI16DT  TWDDDI32DK TWDDAI8DT 

Model Type	Illustration
There are 8 digital output modules: ● 8-point relay output module with a terminal block (TWDDRA8RT) ● 16-point relay output module with a terminal block (TWDDRA16RT) ● 8-point transistor sink module with a connector (TWDDDO8UT) ● 16-point transistor sink module with a connector (TWDDDO16UK) ● 32-point transistor sink module with a connector (TWDDDO32UK) ● 8-point transistor source module with a terminal block (TWDDDO8TT) ● 16-point transistor source module with a connector (TWDDDO16TK) ● 32-point transistor source module with a connector (TWDDDO32TK) These modules can be attached to any controller except the Compact 10 I/O and 16 I/O controllers.	TWDDRA8RT TWDDRA16RT  TWDDDO8UT TWDDDO16UK TWDDDO32UK  TWDDDO8TT TWDDDO16TK TWDDDO32TK 

Model Type	Illustration
There are 2 digital mixed input and output modules: ● 4-point input/4-point output module with a terminal block (TWDDMM8RT) ● 16-point input/8-point output module with a wire-clamp terminal block (TWDDMM24DRF) These modules can be attached to any controller except the Compact 10 I/O and 16 I/O controllers.	TWDDMM8RT TWDDMM24DRF 

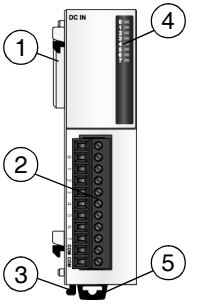
Parts Description of Digital I/O Modules

Introduction

The following section describes the parts of a digital I/O module with a terminal block and with a connector. Your I/O module may differ from the illustrations but the parts will be the same.

Parts Description of a Digital I/O Module with a Terminal Block

The following figure shows the parts of a digital I/O module with a terminal block. This figure is the TWDDDI8DT module.

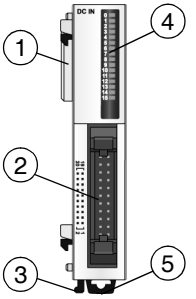


Legend

Label	Description
1	Expansion connector - one on each side, right side not shown
2	Terminal block
3	Latch button
4	LEDs
5	Clamp

Parts Description of a Digital I/O Module with a Connector

The following figure shows the parts of a digital I/O module with a connector. This figure is the TWDDDO16TK module.



Legend

Label	Description
1	Expansion connector - one on each side, right side not shown
2	Connector
3	Latch button
4	LEDs
5	Clamp

Specifications for the Digital I/O Modules

Introduction

This section presents the specifications for the digital I/O modules.

TWDDDI8DT, TWDDDI16DT, TWDDDI16DK, TWDDDI32DK and TWDDAI8DT Specifications

⚠ WARNING

HAZARDS OF UNINTENDED EQUIPMENT OPERATION & EQUIPMENT DAMAGE

If any input exceeding the rated value is applied, permanent damage may be caused.

Failure to follow this instruction can result in death, serious injury, or equipment damage.

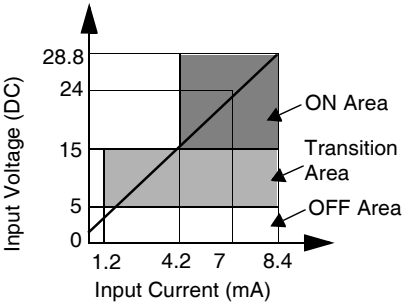
Reference number	Digital I/O Modules TWDD...				
	DI8DT	**DI16DT**	**DI16DK**	**DI32DK**	**AI8DT**
Input points	8	16	16	32	8
Common lines	1	1	1	2	2
Rated input voltage	24 VDC source/sink input signal				120 VAC
Input voltage range	from 20.4 to 28.8 VDC				132 VAC max
Rated input current	7 mA/input (24 VDC)		5 mA/input (24 VDC)		7.5 mA/input (100 VAC)
Input impedance	3.4 kΩ		4.4 kΩ		11 kΩ
Turn on time	8 ms (24 VDC)				25 ms (120 VAC)
Turn off time	8 ms (24 VDC)				30 ms (120 VAC)
Isolation	Between input terminals and internal circuit: photocoupler isolated (isolation protection up to 500 V) Between input terminals: not isolated				
External load for I/O interconnection	Not needed				
Signal determination method	Static				
Input signals type	The input signals can be both sink and source.				The input signals must be of AC type.
Cable length	3m (9.84 ft.) in compliance with electromagnetic immunity				

Reference number	Digital I/O Modules TWDD...				
	DI8DT	**DI16DT**	**DI16DK**	**DI32DK**	**AI8DT**
Connector insertion/removal durability	100 times minimum				
Internal current draw - all inputs on	25 mA (5 VDC) 0 mA (24 VDC)	40 mA (5 VDC) 0 mA (24 VDC)	35 mA (5 VDC) 0 mA (24 VDC)	65 mA (5 VDC) 0 mA (24 VDC)	55 mA (5 VDC) 0 mA (24 VDC)
Internal current draw - all inputs off	5 mA (5 VDC) 0 mA (24 VDC)	5 mA (5 VDC) 0 mA (24 VDC)	5 mA (5 VDC) 0 mA (24 VDC)	10 mA (5 VDC) 0 mA (24 VDC)	25 mA (5 VDC) 0 mA (24 VDC)
Weight	85 g (3 oz)	100 g (3.5 oz)	65 g (2.3 oz)	100 g (3.5 oz)	81 g (2.9 oz)

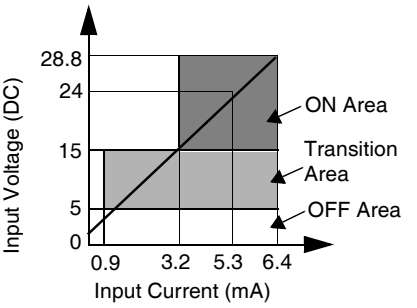
TWDDDI8DT, TWDDDI16DT, TWDDDI16DK, TWDDDI32DK and TWDDAI8DT Operating Range

The operating range of the Type 1 (IEC 61131-2) input module is shown below.

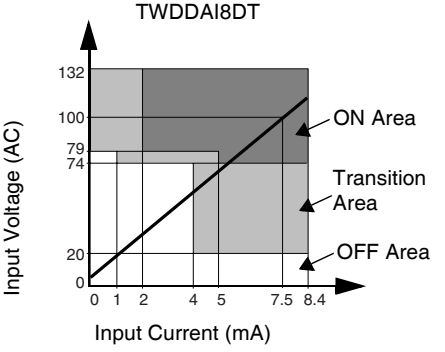
TWDDDI8DT and TWDDDI16DT



TWDDDI16DK and TWDDDI32DK



TWDDAI8DT

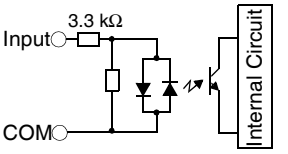


TWDDDI8DT, TWDDDI16DT, TWDDDI16DK, TWDDDI32DK and TWDDAI8DT Internal Circuit

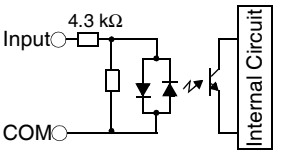
The input internal circuit is shown below.

Standard Sink or Source Input

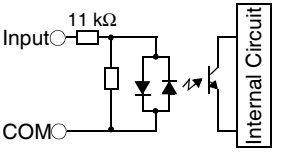
TWDDDI8DT and TWDDDI16DT



TWDDDI16DK and TWDDDI32DK

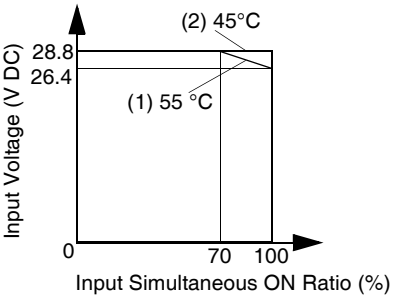


TWDDAI8DT

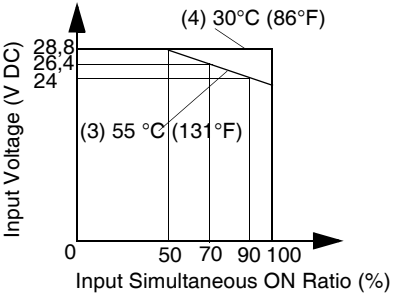


TWDDDI8DT, TWDDDI16DT, TWDDDI16DK, TWDDDI32DK and TWDDAI8DT Usage Limits

When using TWDDDI16DT at 55°C (131°F) in the normal mounting direction, limit the inputs which turn on simultaneously along line (1). At 45°C (113°F), all inputs can be turned on simultaneously at 28.8 VDC as indicated with line (2).



When using TWDDDI16DK and TWDDDI32DK at 55°C (131°F), limit the inputs which turn on simultaneously on each connector along line (3). This limitation applies per connecteur. At 30°C (86°F), all inputs can be turned on simultaneously at 28.8 VDC as indicated with line (4).



When using TWDDDI8DT, all inputs can be turned on simultaneously at 55°C (131°F), input voltage 28.8 VDC.

TWDDRA8RT and TWDDRA16RT Specifications

⚠ CAUTION

ELECTRIC SHOCK & FIRE HAZARDS

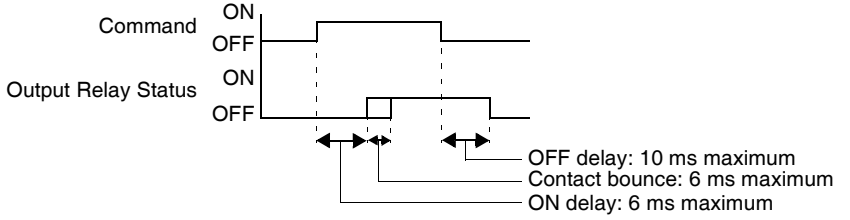
Possible current overload; size wire accordingly.

Failure to follow this instruction can result in injury or equipment damage.

Reference number	TWDDRA8RT	TWDDRA16RT
Output points and common lines	8 NO contacts in 2 common lines	16 NO contacts in 2 common lines
Maximum load current	2 A per output	
	7 A per common line	8 A per common line
Minimum switching load	0.1 mA/0.1 VDC (reference value)	
Initial contact resistance	30 mΩ maximum	
Electrical life	100,000 operations minimum (rated resistive load 1,800 operations/h)	
Mechanical life	20,000,000 operations minimum (no load 18,000 operations/h)	
Rated load (resistive/inductive)	240 VAC/2 A, 30 VDC/2 A	
Dielectric strength	Between output to terminals: 1500 VAC, 1 minute Between output terminal and internal circuit: 1500 VAC, 1 minute Between output groups: 1500 VAC, 1 minute	
Connector insertion/removal durability	100 times minimum	
Internal current draw - all outputs on	30 mA (5 VDC) 40mA (24 VDC)	45 mA (5 VDC) 75 mA (24 VDC)
Internal current draw - all outputs off	5 mA (5 VDC) 0 mA (24 VDC)	5 mA (5 VDC) 0 mA (24 VDC)
Weight	110 g (3.9 oz)	145 g (5.1 oz)

TWDDRA8RT and TWDDRA16RT Delay

The output delay is shown below.



TWDDDO8UT, TWDDDO16UK, and TWDDDO32UK Specifications

Reference number	TWDDDO8UT	TWDDDO16UK	TWDDDO32UK
Output type	Transistor sink output		
Output points per common Line	8 points in 1 common line	16 points in 1 common line	32 points in 2 common lines
Rated load voltage	24 VDC		
Operating load voltage range	from 20.4 to 28.8 VDC		
Rated load current	0.3 A per output	0.1 A per output	
Maximum load current	0.36 A per output at maximum load (0.3 A at nominal load) 3 A per common line	0.12 A per output at maximum load (0.1 A at nominal load) 1 A per common line	
Voltage drop (on voltage)	1 V maximum (voltage between COM and output terminals when output is on)		
Inrush current	1 A maximum		
Leakage current	0.1 mA maximum		
Clamping voltage	39 V +/-1 V		
Maximum lamp load	8 W		
Inductive load	L/R = 10 ms (28.8 VDC, 1 Hz)		
External current draw	100 mA maximum, 24 VDC (power voltage at the +V terminal)		
Isolation	Between output terminal and internal circuit: photocoupler isolated (isolation protection up to 500 V) Between output terminals: not isolated		
Connector insertion/removal durability	100 times minimum		
Internal current draw - all outputs on	10 mA (5 VDC) 20 mA (24 VDC)	10 mA (5 VDC) 40mA (24 VDC)	20 mA (5 VDC) 70 mA (24 VDC)
Internal current draw - all outputs off	5 mA (5 VDC) 0 mA (24 VDC)	5 mA (5 VDC) 0 mA (24 VDC)	10 mA (5 VDC) 0 mA (24 VDC)
Output delay	Turn on time: 300 µs maximum Turn off time: 300 µs maximum		
Weight	85 g (3 oz)	70 g (2.5 oz)	105 g (3.7 oz)

TWDDDO8TT, TWDDDO16TK, and TWDDDO32TK Specifications

Reference number	TWDDDO8TT	TWDDDO16TK	TWDDDO32TK
Output type	Transistor source output		
Output points per common Line	8 points in 1 common line	16 points in 1 common line	32 points in 2 common lines
Rated load voltage	24 VDC		
Operating load voltage range	from 20.4 to 28.8 VDC		
Rated load current	0.3 A per output	0.1 A per output	
Maximum load current	0.36 A per output at maximum load (0.3 A at nominal load) 3 A per common line	0.12 A per output at maximum load (0.1 A at nominal load) 1 A per common line	
Voltage drop (on voltage)	1 V maximum (voltage between COM and output terminals when output is on)		
Inrush current	1 A maximum		
Leakage current	0.1 mA maximum		
Clamping voltage	39 V +/-1 V		
Maximum lamp load	8 W		
Inductive load	L/R = 10 ms (28.8 VDC, 1 Hz)		
External current draw	100 mA maximum, 24 VDC (power voltage at the +V terminal)		
Isolation	Between output terminal and internal circuit: photocoupler isolated (isolation protection up to 500 V) Between output terminals: not isolated		
Connector insertion/removal durability	100 times minimum		
Internal current draw - all outputs on	10 mA (5 VDC) 20 mA (24 VDC)	10 mA (5 VDC) 40mA (24 VDC)	20 mA (5 VDC) 70 mA (24 VDC)
Internal current draw - all outputs off	5 mA (5 VDC) 0 mA (24 VDC)	5 mA (5 VDC) 0 mA (24 VDC)	10 mA (5 VDC) 0 mA (24 VDC)
Output delay	Turn on time: 300 µs maximum Turn off time: 300 µs maximum		
Weight	85 g (3 oz)	70 g (2.5 oz)	105 g (3.7 oz)

TWDDMM8DRT and TWDDMM24DRF Input Specifications

⚠ WARNING

HAZARDS OF UNINTENDED EQUIPMENT OPERATION & EQUIPMENT DAMAGE

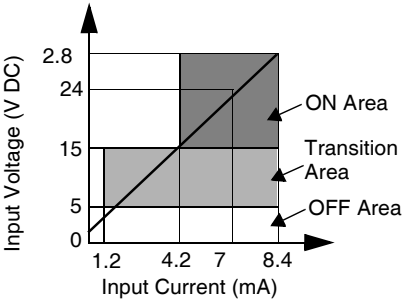
If any input exceeding the rated value is applied, permanent damage may be caused.

Failure to follow this instruction can result in death, serious injury, or equipment damage.

Reference number	TWDDMM8DRT	TWDDMM24DRF
I/O points	4 inputs and 4 outputs	16 inputs and 8 outputs
Rated input voltage	24 VDC source/sink input signal	
Input voltage range	from 20.4 to 28.8 VDC	
Rated input current	7 mA/input (24 VDC)	
Input impedance	3.4 kΩ	
Turn on time (24 VDC)	4 ms (24 VDC)	
Turn off time (24 VDC)	4 ms (24 VDC)	
Isolation	Between input terminals and internal circuit: photocoupler isolated (isolation protection up to 500 V) Between input terminals: not isolated	
External load for I/O interconnection	Not needed	
Signal determination method	Static	
Input signals type	Both sinking and sourcing input signals can be connected.	
Cable length	3m (9.84 ft.) in compliance with electromagnetic immunity	
Connector insertion/removal durability	100 times minimum	Not removable
Internal current draw - all I/O on	25 mA (5 VDC) 20 mA (24 VDC)	65 mA (5 VDC) 45 mA (24 VDC)
Internal current draw - all I/O off	5 mA (5 VDC) 0 mA (24 VDC)	10 mA (5 VDC) 0 mA (24 VDC)
Weight	95 g (3.3 oz)	140 g (4.9 oz)

TWDDMM8DRT and TWDDMM24DRF Input Operating Range

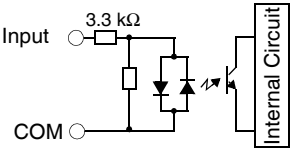
The input operating range of the Type 1 (IEC 61131-2) input module is shown below.



TWDDMM8DRT and TWDDMM24DRF Input Internal Circuit

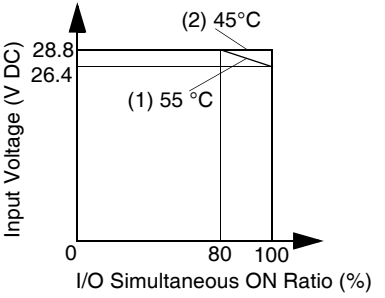
The input internal circuit is shown below.

Standard Sink or Source Input



TWDDMM8DRT and TWDDMM24DRF Usage Limits

When using TWDDMM24DRF at an ambient temperature of 55°C (131°F) in the normal mounting direction, limit the inputs and outputs, respectively, which turn on simultaneously along line (1). At 45°C (113°F), all inputs and outputs can be turned on simultaneously at 28.8 VDC as indicated with line (2).



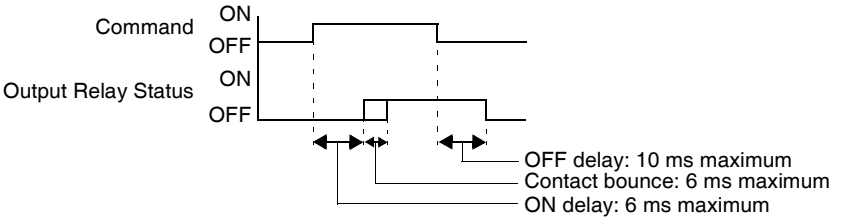
When using TWDDMM8DRT, all inputs and outputs can be turned on simultaneously at 55°C (131°F), input voltage 28.8 VDC.

TWDDMM8DRT and TWDDMM24DRF Output Specifications

Reference number	TWDDMM8DRT	TWDDMM24DRF
Output points and common lines	4 NO contacts in 1 common line	8 NO contacts in 2 common lines
Maximum load current	2 A per output 7 A per common line	
Minimum switching load	0.1 mA/0.1 VDC (reference value)	
Initial contact resistance	30 mΩ maximum	
Electrical life	100,000 operations minimum (rated resistive load 1,800 operations/h)	
Mechanical life	20,000,000 operations minimum (no load 18,000 operations/h)	
Rated load (resistive/inductive)	240 VAC/2 A, 30 VDC/2 A	
Dielectric strength	Between the output and ground terminals: 1500 VAC, 1 minute Between output terminal and internal circuit: 1500 VAC, 1 minute Between output groups: 1500 VAC, 1 minute	

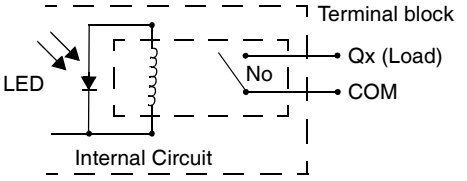
TWDDMM8DRT and TWDDMM24DR Output Delay

The output delay is shown below.



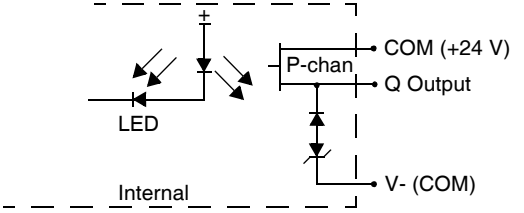
Relay Output Contact

The relay output contact is shown below.



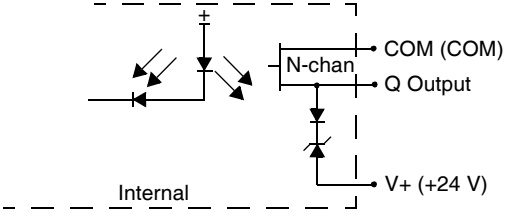
Transistor Source Output Contact

The transistor source output contact is shown below.



Transistor Sink Output Contact

The transistor sink output contact is shown below.



Digital I/O Module Wiring Schematics

Introduction

This section shows examples of wiring schematics for the digital I/O modules.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK

- Be sure to remove ALL power from ALL devices before connecting or disconnecting inputs or outputs to any terminal or installing or removing any hardware.
- Be sure to connect the grounding wire to a proper ground.

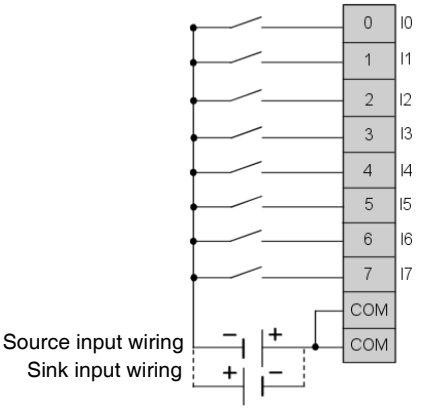
Failure to follow this instruction will result in death, serious injury, or equipment damage.

Note: These schematics are for external wiring only.

Note: The shaded boxes are markings on the digital I/O modules. The I and Q numbers are the input and output points.

TWDDDI8DT Wiring Schematic

This schematic is for the TWDDDI8DT module.



- The two COM terminals are connected together internally.

TWDDAI8DT Wiring Schematic

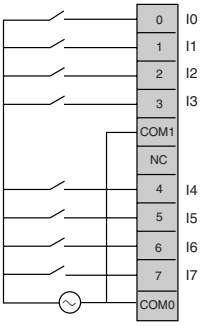
⚠ DANGER

HAZARD OF ELECTRIC SHOCK, BURN OR EXPLOSION

Turn off all power before starting installation, removal, wiring, maintenance or inspection of the smart relay system.

Failure to follow this instruction will result in death, serious injury, or equipment damage.

This schematic is for the TWDDAI8DT module.

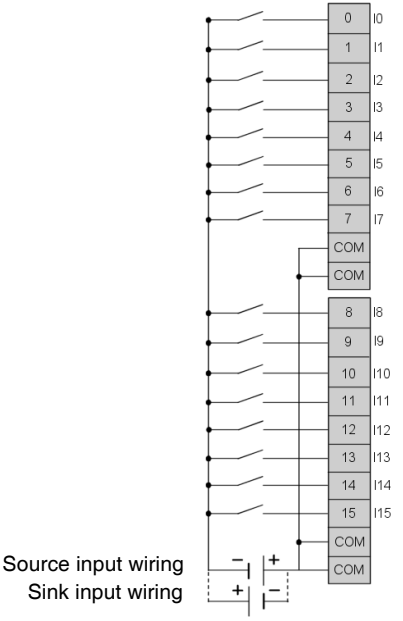


120 VAC input wiring

- The two COM terminals are **not** connected together internally.

TWDDDI16DT Wiring Schematic

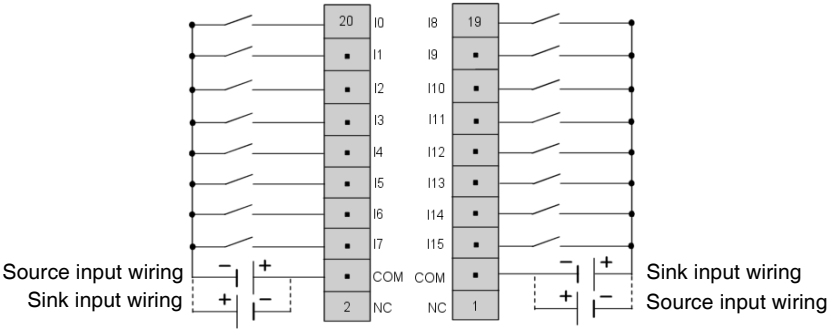
This schematic is for the TWDDDI16DT module.



- The four COM terminals are connected together internally.

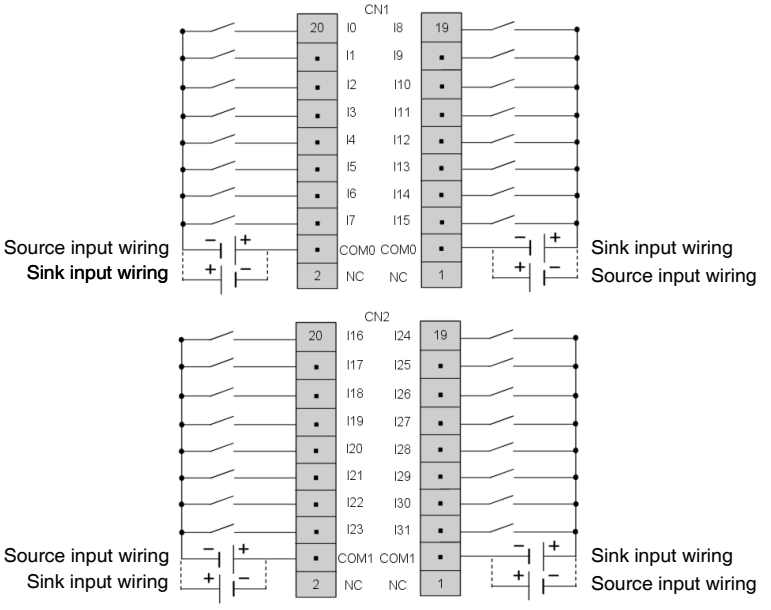
TWDDDI16DK Wiring Schematic

This schematic is for the TWDDDI16DK module.



TWDDDI32DK Wiring Schematic

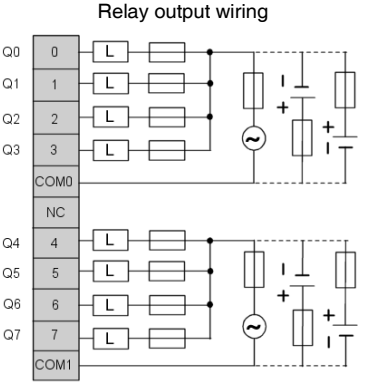
This schematic is for the TWDDDI32DK module.



- The COM0 terminals are connected together internally.
- The COM1 terminals are connected together internally.
- The COM0 and COM1 terminals are **not** connected together internally.

TWDDRA8RT Wiring Schematic

This schematic is for the TWDDRA8RT module.

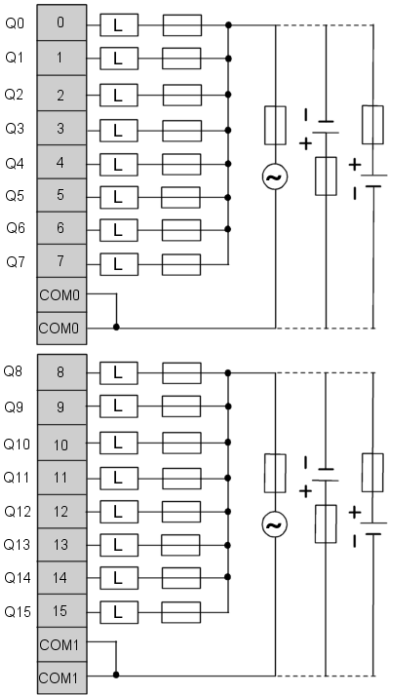


- The COM0 and COM1 terminals are **not** connected together internally.
- Connect an appropriate fuse for the load.

TWDDRA16RT Wiring Schematic

This schematic is for the TWDDRA16RT module.

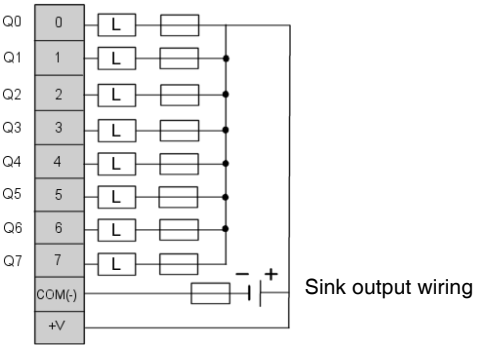
Relay output wiring



- The COM0 terminals are connected together internally.
- The COM1 terminals are connected together internally.
- The COM0 and COM1 terminals are **not** connected together internally.
- Connect an appropriate fuse for the load.

TWDDDO8UT Wiring Schematic

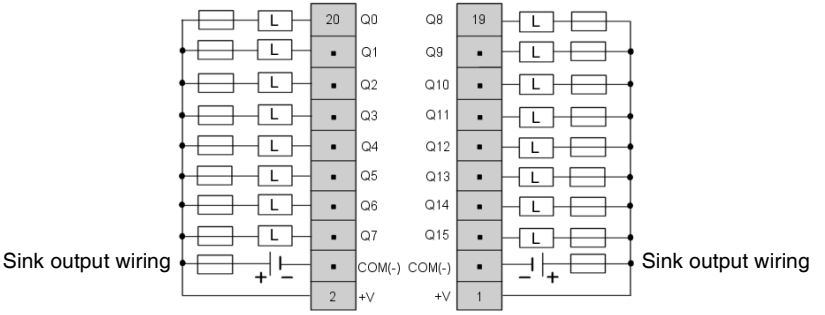
This schematic is for TWDDDO8UT module.



- Connect an appropriate fuse for the load.

TWDDDO16UK Wiring Schematic

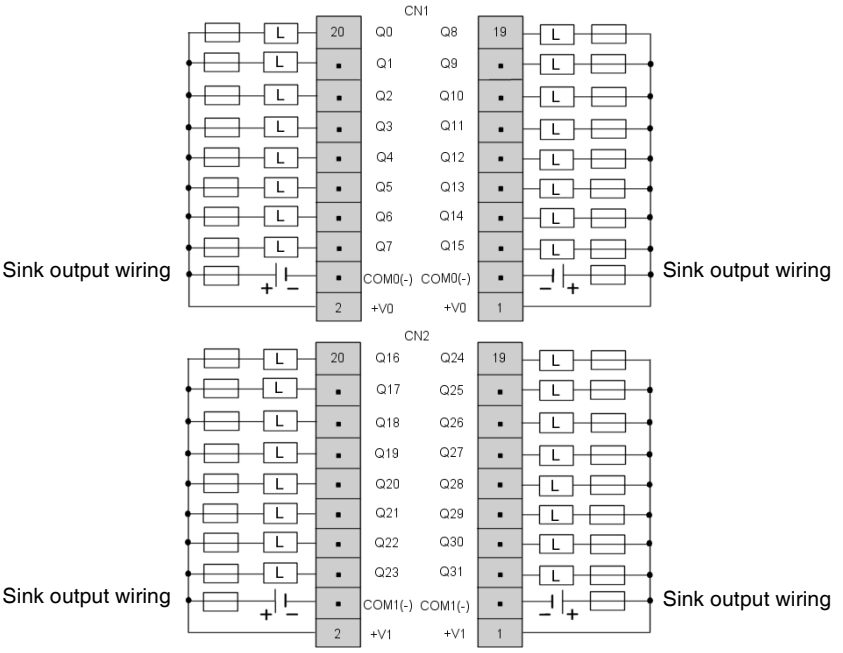
This schematic is for the TWDDDO16UK module.



- The COM(-) terminals are connected together internally.
- The +V terminals are connected together internally.
- Connect an appropriate fuse for the load.

TWDDDO32UK Wiring Schematic

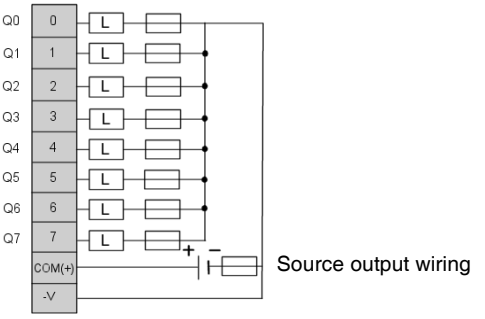
This schematic is for the TWDDDO32UK module.



- Terminals on CN1 and CN2 are **not** connected together internally.
- The COM0(-) terminals are connected together internally.
- The COM1(-) terminals are connected together internally.
- The +V0 terminals are connected together internally.
- The +V1 terminals are connected together internally.
- Connect an appropriate fuse for the load.

TWDDDO8TT Wiring Schematic

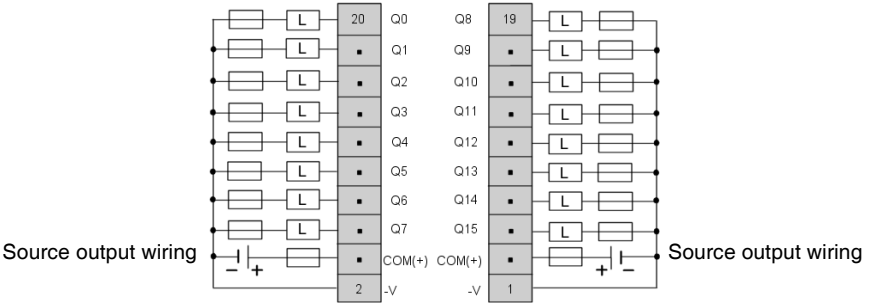
This schematic is for the TWDDDO8TT module.



- Connect an appropriate fuse for the load.

TWDDDO16TK Wiring Schematic

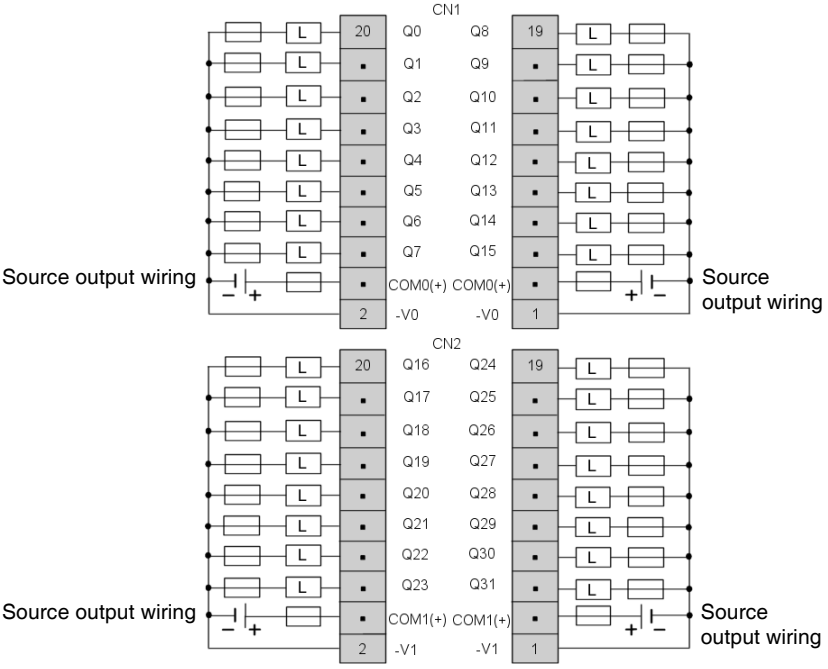
This schematic is for the TWDDDO16TK module.



- The COM(+) terminals are connected together internally.
- The -V terminals are connected together internally.
- Connect an appropriate fuse for the load.

TWDDDO32TK Wiring Schematic

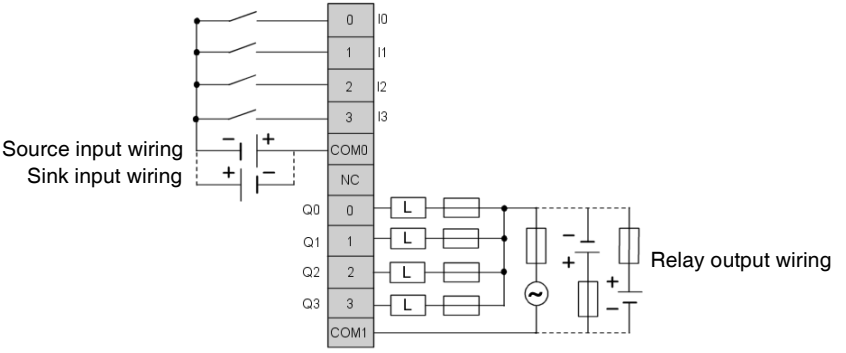
This schematic is for the TWDDDO32TK module.



- Terminals CN1 and CN2 are **not** connected together internally.
- The COM0(+) terminals are connected together internally.
- The COM1(+) terminals are connected together internally.
- The -V0 terminals are connected together internally.
- The -V1 terminals are connected together internally.
- Connect an appropriate fuse for the load.

TWDDMM8DRT Wiring Schematic

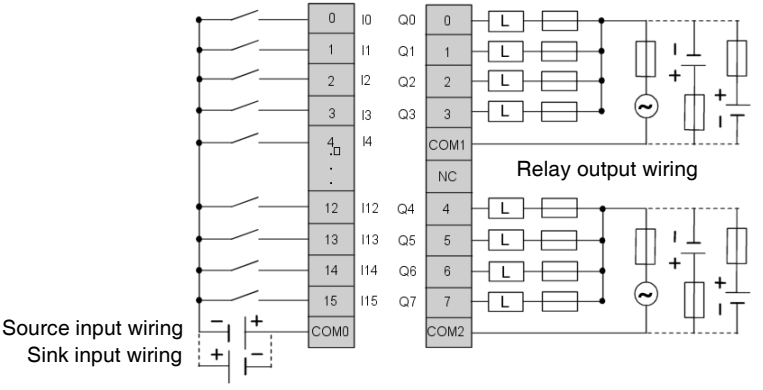
This schematic is for the TWDDMM8DRT module.



- The COM0 and COM1 terminals are **not** connected together internally.

TWDDMM24DRF Wiring Schematic

This schematic is for the TWDDMM24DRF module.



- The COM0, COM1 and COM2 terminals are **not** connected together internally.
- Connect an appropriate fuse for the load.

2.5 Analog I/O Modules

At a Glance

Introduction

This section provides an overview, specifications, and wiring schematics of the analog I/O modules.

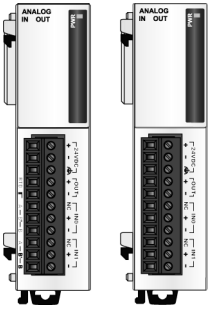
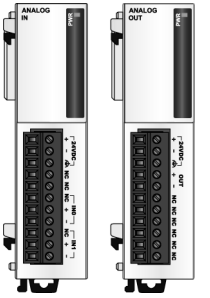
What's in this Section?

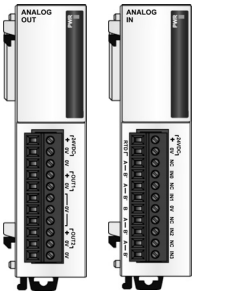
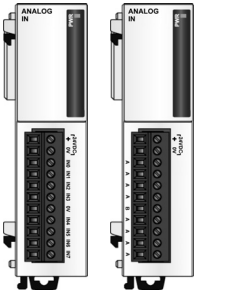
This section contains the following topics:

Overview of Analog I/O Modules

Introduction The following section provides an overview of the analog I/O modules.

Illustrations The following illustrations present the analog I/O modules.

Controller Type	Illustration
These 2 analog I/O modules are: ● 2-point input/1-point output module with a terminal block, accepts thermocouple and resistance thermometer signals (TWDALM3LT) ● 2-point input/1-point output module with a terminal block (TWDAMM3HT) These modules can be attached to any controller except the Compact 10 I/O and 16 I/O controllers.	TWDALM3LT TWDAMM3HT 
These 2 analog I/O modules are: ● 2-point input module with a terminal block (TWDAMI2HT) ● 1-point output module with a terminal block (TWDAMO1HT) These modules can be attached to any controller except the Compact 10 I/O and 16 I/O controllers.	TWDAMI2HT TWDAMO1HT 

Controller Type	Illustration
These 2 analog I/O modules are: ● 2-point output module with a terminal block (TWDAVO2HT) ● 4-point input module, current, voltage and temperature, with a terminal block (TWDAMI4LT) These modules can be attached to any controller except the Compact 10 I/O and 16 I/O controllers.	TWDAVO2HT TWDAMI4LT 
These 2 analog I/O modules are: ● 8-point input module, current and voltage, with a terminal block (TWDAMI8HT) ● 8-point input module, temperature, with a terminal block (TWDARI8HT) These modules can be attached to any controller except the Compact 10 I/O and 16 I/O controllers.	TWDAMI8HT TWDARI8HT 

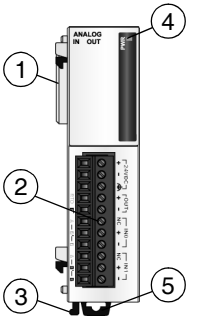
Parts Description of Analog I/O Modules

Introduction

The following section describes the parts of an analog I/O module. Your I/O module may differ from the illustrations but the parts will be the same.

Parts Description of an Analog I/O Module

The following figure shows the parts of an analog I/O module. This figure is the TWDALM3LT module.



Legend

Label	Description
1	Expansion connector - one on each side, right side not shown
2	Removable terminal block
3	Latch button
4	LEDs
5	Clamp

General Specifications for the Analog I/O Module

Introduction

This section is general specifications for analog I/O modules.

General Specifications

Reference	TWDALM3LT - TWDAMM3HT - TWDAMI2HT - TWDAMO1HT	TWDAVO2HT - TWDAMI4LT	TWDAMI8HT - TWDARI8HT
Rated power voltage	24 VDC		
Allowable voltage range	from 20.4 to 28.8 VDC	from 19.2 to 30.0 VDC including ripple	from 19.2 to 30.0 VDC including ripple
Average number of connector insertions/ removals	100 times minimum		
Internal current draw - internal power	50mA (5 VDC) 0 mA (24 VDC)	60mA (5 VDC) 0 mA (24 VDC)	
Internal current draw - external power	40mA (24 VDC)	60mA (24 VDC)	45mA (24 VDC)
Weight	85 g (3 oz)		

I/O Specifications for the Analog I/O Module

Introduction This section is I/O specifications for the analog I/O modules.

Voltage and Current Input Specifications The Analog Modules that comply with the Voltage and Current Input Specifications are: TWDAMI2HT, TWDAMM3HT, TWDAMI4LT and TWDAMI8HT.

Voltage Input Specifications:

Analog Input Specifications	**Voltage Input**		
	TWDAMI2HT TWDAMM3HT	**TWDAMI4LT**	**TWDAMI8HT**
Input range	from 0 to 10 VDC		
Input impedance	1 MΩ min.		
Sample duration time	16 ms max.	160 ms	
Sample repetition time	16 ms max.	4 x 160 ms	8 x 160 ms
Total input system transfer time	32 ms + 1 scan time[1]	4x160 ms + 1 scan time[1]	8 x 160 ms + 1 scan time[1]
Input type	Single-ended input	Non differential	
Operating mode	Self-scan		
Conversion mode	ΣΔ type ADC		
Input error - maximum error at 25°C (77°F)	±0.2 % of full scale	0.5% of full scale	1% of full scale
Input error - temperature coefficient	±0.006% of full scale/°C	±0.005% of full scale/°C	
Input error - repeatable after stabilization time	±0.5 % of full scale	2 LSB	
Input error - nonlinear	±0.2 % of full scale	±0.002 % of full scale	
Input error - maximum error	±1 % of full scale	0.5% of full scale	1% of full scale
Digital resolution	4096 increments (12 bits)	12 bits	10 bits
Input value of LSB	2.5 mV	2.5 mV	9.7 mV
Data type in application program	0 to 4095 (12 bit data) -32768 to 32767 (optional range designation)[2]	0 to 4095 (12 bit) -32768 to 32767 Custom	0 to 1023 (10 bit) -32768 to 32767 Custom
Monotonicity	Yes		
Input data out of range	Detectable[3]		
Noise resistance - maximum temporary deviation during electrical noise tests	±3% maximum when a 500 V clamp voltage is applied to the power and I/O wiring	±0.5% of full scale	±1% of full scale

Analog Input Specifications	Voltage Input		
	TWDAMI2HT TWDAMM3HT	**TWDAMI4LT**	**TWDAMI8HT**
Noise resistance - common mode characteristics	Common mode reject ratio (CMRR): -50 dB	Common mode reject ratio (CMRR): -90 dB	
Noise resistance - common mode voltage	16 VDC	15 VDC	15 VDC
Noise resistance - input filter	No	ADC's notch filter	
Noise resistance - cable	Twisted-pair shielded cable is recommended for improved noise immunity	Cable <30 m	
Noise resistance - crosstalk	2 LSB maximum	1 LSB maximum	1 LSB maximum
Dielectric strength	500 V between input and power circuit	2500 V between input and power circuit	
Type of protection	Photocoupler between input and internal circuit		
Maximum permanent allowed overload (no damage)	13 VDC		
Selection of analog input signal type	Using software programming		
Calibration or verification to maintain rated accuracy	Approximately 10 years		

Current Input Specifications:

Analog Input Specifications	Current Input		
	TWDAMI2HT TWDAMM3HT	**TWDAMI4LT**	**TWDAMI8HT**
Input range	from 4 to 20 mA DC	from 0 to 20 mA	
Input impedance	10 Ω	470 Ω	
Sample duration time	16 ms max.	160 ms	
Sample repetition time	16 ms max.	4x160 ms	8x160 ms
Total input system transfer time	32 ms + 1 scan time[1]	4x160 ms + 1 scan time[1]	8x160 ms + 1 scan time[1]
Input type	Differential input	Non differential	
Operating mode	Self-scan		
Conversion mode	ΣΔ type ADC		
Input error - maximum error at 25°C (77°F)	±0.2 % of full scale	0.5% of full scale	1% of full scale
Input error - temperature coefficient	±0.006% of full scale/°C	±0.005% of full scale/°C	
Input error - repeatable after stabilization time	±0.5 % of full scale	2 LSB	
Input error - nonlinear	±0.2 % of full scale	±0.002 % of full scale	

Analog Input Specifications	**Current Input**		
	TWDAMI2HT **TWDAMM3HT**	**TWDAMI4LT**	**TWDAMI8HT**
Input error - maximum error	±1 % of full scale	±0.5% of full scale	±1 % of full scale
Digital resolution	4096 increments (12 bits)	4096 increments (12 bits)	1024 increments (10 bits)
Input value of LSB	4 µA	4.8 µA	19.5 µA
Data type in application program	0 to 4095 (12 bit data) -32768 to 32767 (optional range designation)[2]	0 to 4095 (12 bit) -32768 to 32767 Custom	0 to 1023 (10 bit) -32768 to 32767 Custom
Monotonicity	Yes		
Input data out of range	Detectable[3]		
Noise resistance - maximum temporary deviation during electrical noise tests	±3% maximum when a 500 V clamp voltage is applied to the power and I/O wiring	±0.5% of full scale	±1% of full scale
Noise resistance - common mode characteristics	Common mode reject ratio (CMRR): -50 dB	Common mode reject ratio (CMRR): -90 dB	
Noise resistance - common mode voltage	16 VDC	15 VDC	15 VDC
Noise resistance - input filter	No	ADC's notch filter	
Noise resistance - cable	Twisted-pair shielded cable is recommended for improved noise immunity	Cable <30 m	
Noise resistance - crosstalk	2 LSB maximum	1 LSB maximum	1 LSB maximum
Dielectric strength	500 V between input and power circuit	2500 V between input and power circuit	
Type of protection	Photocoupler between input and internal circuit		
Maximum permanent allowed overload (no damage)	40 mA DC		
Selection of analog input signal type	Using software programming		
Calibration or verification to maintain rated accuracy	Approximately 10 years		

Thermocouple and Temperature Input Specifications

The Analog Modules that comply with the Thermocouple and/or Temperature Input Specifications are: TWDALM3LT, TWDAMI4LT, and TWDARI8HT.

Analog Input Specifications	Thermocouple	Temperature Probes		
	TWDALM3LT	TWDALM3LT	TWDAMI4LT	TWDARI8HT
Input range	Type K (0 to 1300 °C) (32 to 2372 °F) Type J (0 to 1200 °C) (32 to 2192 °F) Type T (0 to 400 °C) (32 to 742 °F)	(RTD) Pt 100 3-wire type (-100 to 500°C) (-148 to 932 °F)	(RTD) Pt 100, Pt 1000, Ni 100, Ni 1000 3-wire type (-100 to 500 °C) (-148 to 932 °F)	NTC or PTC thermistor 100 to 1,000 ohms temperature range
Input impedance	1 MΩ min.		1 MΩ min.	1 MΩ min.
Sample duration time	50 ms max.		160 ms	
Sample repetition time	50 ms max.		4x160 ms	8x160 ms
Total input system transfer time	100 ms + 1 scan time[1]		4x160 ms + 1 scan time[1]	8x160 ms + 1 scan time[1]
Input type	Differential input			
Operating mode	Self-scan			
Conversion mode	ΣΔ type ADC			
Input error - maximum error at 25°C (77°F)	±0.2% of full scale plus reference junction compensation accuracy ±4°C max	±0.2% of full scale	0.5% of full scale	1% of full scale
Input error - temperature coefficient	±0.006% of full scale/°C		±0.005% of full scale/°C	
Input error - repeatable after stabilization time	±0.5% of full scale		2 LSB	
Input error - nonlinear	±0.2% of full scale		±0.002% of full scale	
Input error - maximum error	±1% of full scale		±0.5% of full scale	±1% of full scale
Digital resolution	4096 increments (12 bits)		12 bits	10 bits

Analog Input Specifications	Thermocouple	Temperature Probes		
	TWDALM3LT	TWDALM3LT	TWDAMI4LT	TWDARI8HT
Input value of LSB	K: 0.325 °C (K: 0.585 °F) J: 0.300 °C (J: 0.540 °F) T: 0.100 °C (T: 0.180 °F)	K: 0.15 °C (K: 0.27 °F)	K: 0.15 °C (K: 0.27 °F)	Depending on the probe
Data type in application program	0 to 4095 (12 bit data) -32768 to 32767 (optional range designation)[2]		0 to 4095 (12 bit data) -32768 to 32767 Custom	0 to 1023 (10 bit data) -32768 to 32767 Custom
Monotonicity	Yes			
Input data out of range	Detectable[3]			
Noise resistance - maximum temporary deviation during electrical noise tests	±3% maximum when a 500 V clamp voltage is applied to the power and I/O wiring	Accuracy is not assured when noise is applied	±0.5% of full scale	±1% of full scale
Noise resistance - common mode characteristics	Common mode reject ratio (CMRR): -50 dB		Common mode reject ratio (CMRR): -90 dB	
Noise resistance - common mode voltage	16 VDC		15 VDC	15 VDC
Noise resistance - input filter	No		ADC's notch filter	
Noise resistance - cable	—		Cable <30 m	
Noise resistance - crosstalk	2 LSB maximum		1 LSB maximum	1 LSB maximum
Dielectric strength	500 V between input and power circuit		2500 V between input and power circuit	
Type of protection	Photocoupler between input and internal circuit			
Maximum permanent allowed overload (no damage)	—		—	—
Selection of analog input signal type	Using software programming			None
Calibration or verification to maintain rated accuracy	Approximately 10 years			

Note:

1. Total input system transfer time = sample repetition x 2 + 1 scan time.
2. The 12-bit data (0 to 4095) and 10-bit data (0 to 1023) processed in the Analog I/O module can be linear-converted to a value between -32768 and 32767. The optional range designation and analog I/O data minimum and maximum values can be selected using data registers allocated to analog I/O modules.
3. When an error is detected, a corresponding error code is stored to a data register allocated to analog I/O operating status.

Voltage and Current Output Specifications

The Analog Modules that comply with the Voltage and Current Output Specifications are: TWDAMO1HT, TWDAMM3HT, TWDLM3LT. One Module complies with the Voltage Output Specifications only: TWDAVO2HT.

Analog Output Specifications	**Voltage output**		**Current Output**
	TWDAMO1HT TWDAMM3HT TWDLM3LT	**TWDAVO2HT**	**TWDAMO1HT TWDAMM3HT TWDLM3LT**
Output range	from 0 to 10 VDC	from -10 to 10 VDC	from 4 to 20 mA DC
Load impedance	2 kΩ max	> 3 kΩ	300 Ω maximum
Application load type	Resistive load		
Settling time	20 ms	2 ms	20 ms
Total output system transfer Time	20 ms + 1 scan time	2 ms + 1 scan time	20 ms + 1 scan time
Output error - maximum error at 25°C (77°F)	±0.2% of full scale	1% of full scale	±0.2% of full scale
Output error - temperature coefficient	±0.015% of full scale/°C	±0.01% of full scale/°C	±0.015% of full scale/°C
Output error - repeatable after stabilization time	±0.5 % of full scale	±0.1% of full scale	±0.5% of full scale
Output error - output voltage drop	±1% of full scale	±0.5% of full scale	±1% of full scale
Output error - nonlinear	±0.2% of full scale		
Output error - output ripple	1 LSB maximum		
Output error - overshoot	0%		
Output error - total error	±1 % of full scale		
Digital resolution	4096 increments (12 bits)	11 bits + sign	4096 increments (12 bits)
Output value of LSB	2.5 mV	+/- 4.8 mV	4 µA
Data type in application program	0 to 4095 (12 bit data) -32768 to 32767 (optional range designation)[1]	-2048 to 2047	0 to 4095 (12 bit data) -32768 to 32767 (optional range designation)[1]
Monotonicity	Yes		
Current loop open	—	Not detectable	Detectable[2]
Noise resistance - maximum temporary deviation during electrical noise tests	±3% maximum when a 500 V clamp voltage is applied to the power and I/O wiring	±1% of full scale	±3% maximum when a 500 V clamp voltage is applied to the power and I/O wiring

Analog Output Specifications	Voltage output		Current Output
	TWDAMO1HT TWDAMM3HT TWDLM3LT	**TWDAVO2HT**	**TWDAMO1HT TWDAMM3HT TWDLM3LT**
Noise resistance - cable	Twisted-pair shielded cable is recommended for improved noise immunity	Cable >30 m	Twisted-pair shielded cable is recommended for improved noise immunity
Noise resistance - crosstalk	No crosstalk because of 1 channel output		
Dielectric strength	500 V between output and power circuit	2500 V between output and power circuit	500 V between output and power circuit
Type of protection	Photocoupler between output and internal circuit		
Selection of analog output signal type	Using software programming	None	Using software programming
Calibration or verification to maintain rated accuracy	Approximately 10 years		

Note:

1. The 12-bit data (0 to 4095) processed in the Analog I/O module can be linear-converted to a value between -32768 and 32767. The optional range designation and analog I/O data minimum and maximum values can be selected using data registers allocated to analog I/O modules.
2. When an error is detected, a corresponding error code is stored to a data register allocated to analog I/O operating status.

Analog I/O Modules Wiring Schematics

Introduction

This section shows examples of wiring schematics for the Analog I/O modules.

TWDALM3LT Wiring Schematic

⚠ WARNING

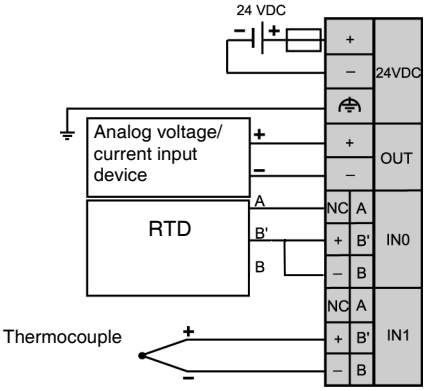
HAZARDS OF UNINTENDED EQUIPMENT OPERATION & EQUIPMENT DAMAGE

- Do not connect any wiring to unused channels.
- Do not connect the thermocouple to a hazardous voltage (30 V_{RMS} or 42.4 V_{peak} or higher.)

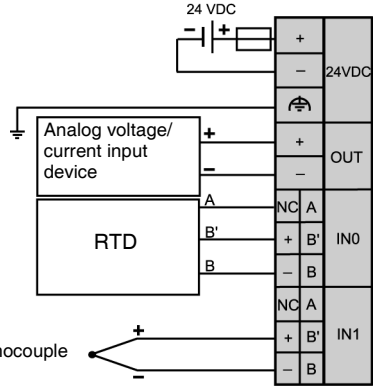
Failure to follow this instruction can result in death, serious injury, or equipment damage.

This schematic is for the TWDALM3LT module.

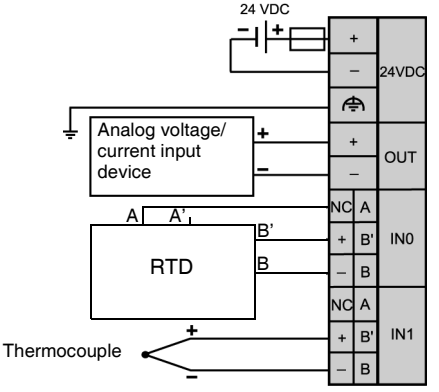
2-wire cabling:



3-wire cabling:



4-wire cabling:

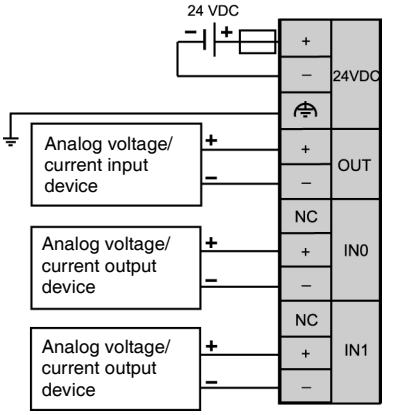


Note: For 4-wire cabling, output A' is not connected.

- Connect a fuse appropriate for the applied voltage and current draw, at the position shown in the diagram.
- When connecting an RTD, connect the three wires to terminals A, B', and B of input channel 0 or 1.
- When connecting a thermocouple, connect the two wires to terminals B' and B of input channel 0 or 1.

TWDAMM3HT Wiring Schematic

This schematic is for the TWDAMM3HT module.

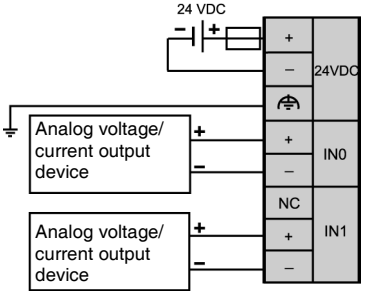


- Connect a fuse appropriate for the applied voltage and current draw, at the position shown in the diagram.
- Do not connect any wiring to unused channels.

Note: The (-) poles of inputs IN0 and IN1 are connected internally.

TWDAMI2HT Wiring Schematic

This schematic is for the TWDAMI2HT module.

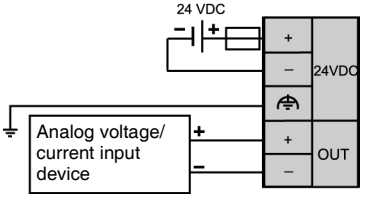


- Connect a fuse appropriate for the applied voltage and current draw, at the position shown in the diagram.
- Do not connect any wiring to unused channels.

Note: The (-) poles of inputs IN0 and IN1 are connected internally.

TWDAMO1HT Wiring Schematic

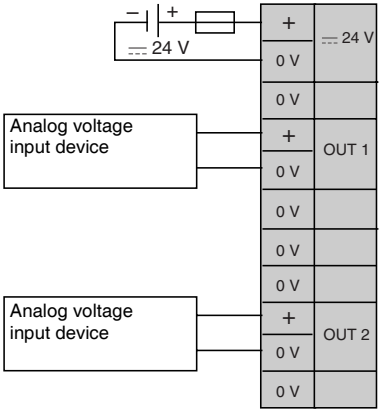
This schematic is for the TWDAMO1HT module.



- Connect a fuse appropriate for the applied voltage and current draw, at the position shown in the diagram.
- Do not connect any wiring to unused channels.

TWDAVO2HT Wiring Schematic

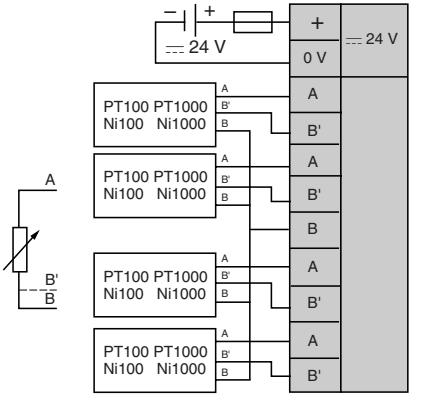
This schematic is for the TWDAVO2HT module.



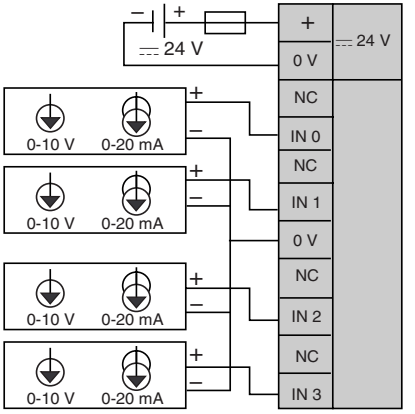
- Connect a fuse appropriate for the applied voltage and current draw, at the position shown in the diagram.
- Do not connect any wiring to unused channels.

TWDAMI4LT Wiring Schematic

This schematic is for the TWDAMI4LT module configured for temperature measurements.



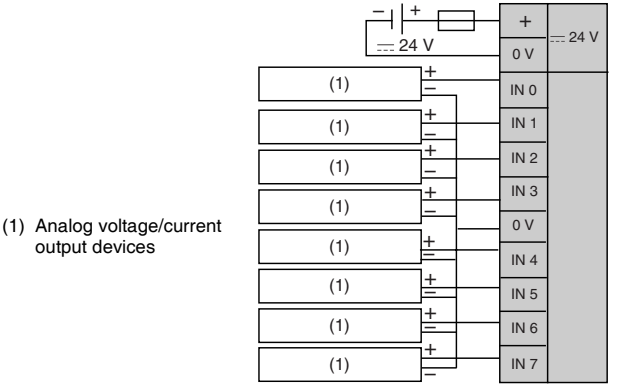
This schematic is for the TWDAMI4LT module configured for voltage or current input.



- Connect a fuse appropriate for the applied voltage and current draw, at the position shown in the diagram.
- Do not connect any wiring to unused channels.

TWDAMI8HT Wiring Schematic

This schematic is for the TWDAMI8HT module.

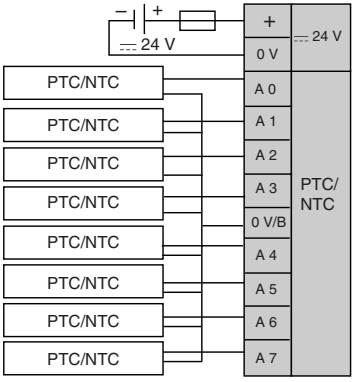


(1) Analog voltage/current output devices

- Connect a fuse appropriate for the applied voltage and current draw, at the position shown in the diagram.
- Do not connect any wiring to unused channels.

TWDARI8HT Wiring Schematic

This schematic is for the TWDARI8HT module.



- Connect a fuse appropriate for the applied voltage and current draw, at the position shown in the diagram.
- Do not connect any wiring to unused channels.

2.6 AS-Interface V2 bus master module

At a Glance

Introduction

This section provides a review of the AS-Interface bus, presents the description, specifications and use of the AS-Interface master module**TWDNOI10M3**.

What's in this Section?

This section contains the following topics:

Reminder about the AS-Interface bus

General

The AS-Interface (abbreviation for Actuator-Sensor-Interface) bus is a field bus (level 0), and can be used to connect sensors/actuators. This allows "discrete" or analog type information to run between a bus "master" and sensor/actuator type "slave" devices.

AS-Interface is made up of three major basic elements:
- a specific supply providing a 30 VDC voltage,
- a bus master,
- one or more slave devices (sensors, actuators and others).

These components are interconnected by a two-wire cable dedicated to data transmission and power supply.

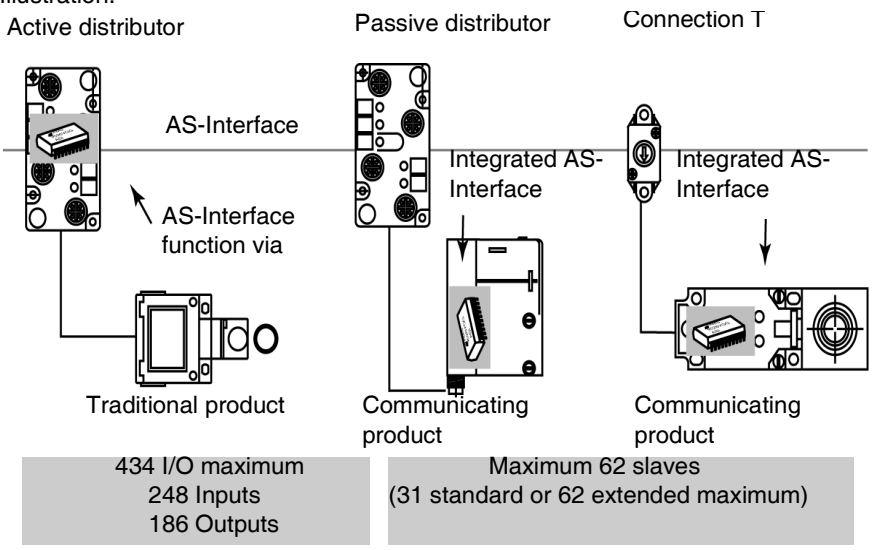
The main types of sensors/ actuators

Table of the main types of sensors:

Type of sensor	Description
Communicating sensors/ actuators (compatible with AS-Interface)	Thanks to the integrated AS-Interface feature, they connect directly to the AS-Interface bus via a passive dispatcher or a connection T.
Traditional sensors/actuators (not compatible with AS-Interface)	They connect to the bus via an AS-Interface interface (active dispatcher). These interfaces connect the sensors and traditional actuators to the AS-Interface bus and provide them with dialog capacity on the bus.

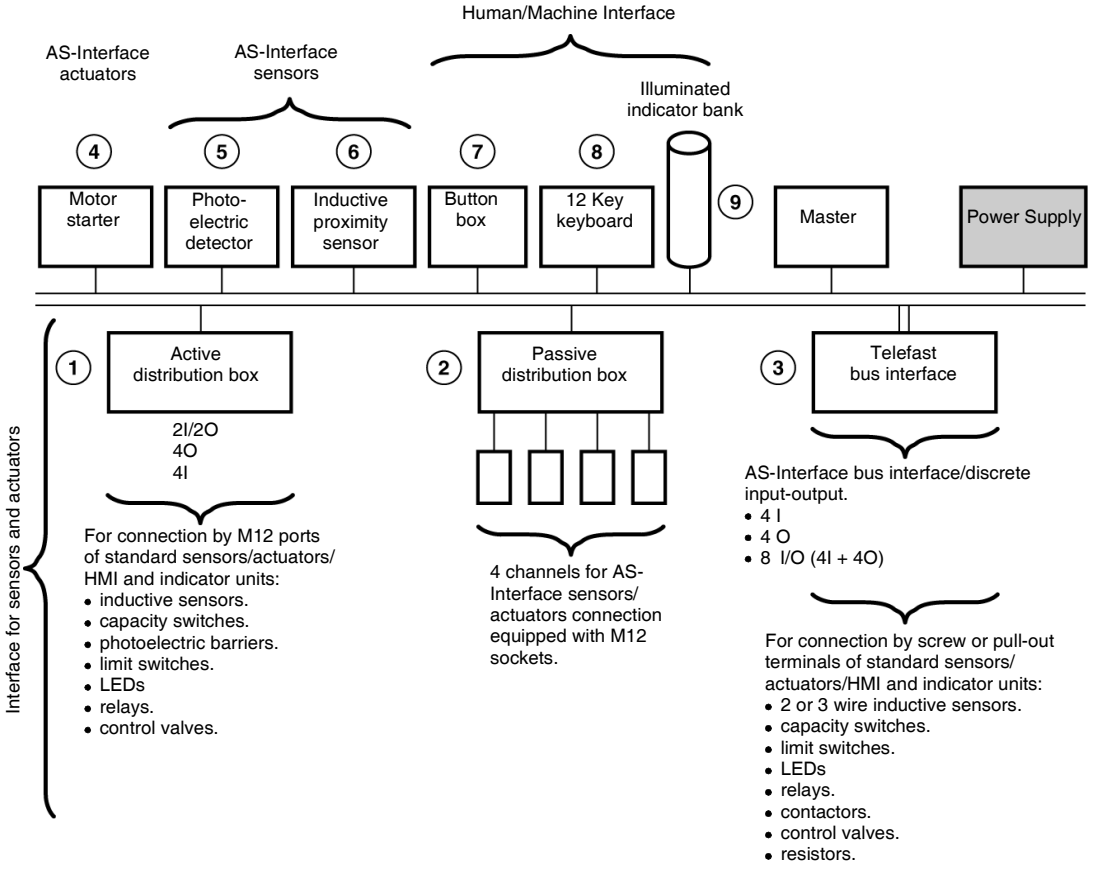
Illustration

Illustration:



Overview of AS-Interface Products from the Schneider Catalog

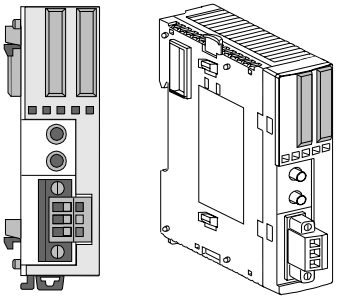
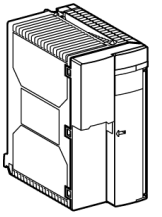
Non-exhaustive list of AS-Interface products from the Schneider catalog:

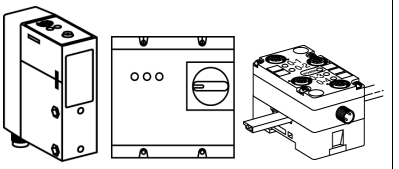


Presentation of the main constituent elements of the AS-Interface bus

Introduction to the Main Constituent Elements

The following table lists the main constituent elements of an AS-Interface bus:

Part	Illustration
AS-Interface bus master Connected to a modular controller or a compact TWDLC•A24DRF or TWDLCA•40DRF series, it manages all exchange of data on the AS-Interface network. It also enables slave status to be monitored.	 Module TWDNOI10M3
AS-Interface Power Supply Specific AS-Interface power supplies, dedicated to 30 VDC, designed to supply the constituents connected to the AS-Interface bus. The power supply is distributed with the same medium used for data exchange.	 Power supply (30 VDC)
Cable This transmits data and carries the power. It can be made up from: • Either a standard two-wire AS-Interface yellow ribbon cable, unshielded and polarized, • Or a standard round, shielded or unshielded two-wire cable.	 Guiding ribbon cable  Round cable

Part	Illustration
Slaves Different types of slaves can be connected to the AS-Interface, bus, including the sensors, actuators and splitters, as well as the analog slaves. Slaves are available as slaves with standard address settings, or as slaves with extended address settings (A/B).	 Sensor Actuator Passive

Main specifications of the AS-Interface V2 Bus

Overview

AS-Interface is a system in which exchange management is ensured by a single master which, by scanning the bus, calls each detected slave in succession and awaits a response. The master manages the inputs/outputs, parameters and identity codes of each slave, as well as their addressing.

For slaves with AS-Interface V2 standard addressing, the serial communications frame carries:

- 4 data bits (D0 to D3), which are the image of inputs or outputs according to the type of interface,
- 4 parametering bits (P0 to P3), which are used to set the operating modes of the interface.

Communication series frame for slaves with extended addressing settings:

- 4 data bits (D0 to D3), which are the image of inputs or outputs according to the type of interface,
- 3 parametering bits (P0 to P2), which are used to set the operating modes of the interface.

All slave devices connected to the AS-Interface bus are identified by at least one "I/O Code" and one "ID code" which completes the functional identification of the slave. Some slaves have an ID2 and ID1 code, which define the internal functions of the slave: on analog slaves, for example, ID2 shows the slave's analog channel number. In the AS-Interface master request, outputs are positioned and AS-Interface input devices are sent back in the slave's response.

Table of Main Specifications

The following table provides the main specifications of the AS-Interface V2 bus:

Specifications	Description
Slave Addressing	Each slave connected to the AS-Interface bus must have an address between 1 and 31, accompanied by "bank" /A or "bank" /B for extended addressing. The slaves delivered from the factory have the address 0 (the address of the slave is memorized in a non-volatile format). Addresses are programmed using a specialized addressing terminal.
Identification of Slaves	All slave devices connected to the AS-Interface bus are identified by: • an ID identity code (coded on 4 bits) that specifies the type of slave (sensor, extended slave, etc.). For example, the ID code of an extended slave is 0xA, • an I/O code (coded on 4 bits) that shows input/output distribution. For example, the I/O code of a slave with 4 inputs is 0, with 4 inputs is 8 and with 2 I/2O is 4, • an ID2 code (coded on 4 bits) that specifies the internal functionalities of the slave, • an ID1 code (coded on 4 bits) that specifies an additional slave identity, These identifications allow the AS-Interface master to recognize the configuration present on the bus. These different profiles have been developed by the AS-Interface association. They are used to distinguish between input, output and mixed modules, "intelligent" device families, etc.
Maximum number of slaves and inputs/outputs	On the same bus, an AS-Interface bus can support a maximum of: • 31 slaves with standard address settings; each slave can have a maximum of 4 inputs and/or 4 outputs, with addresses from 1 to 31, • 62 slaves with extended address settings; each slave can have a maximum of 4 inputs and/or 3 outputs, with addresses from 1 A/B to 31A/B. This makes it possible to manage a maximum of 248 inputs +186 outputs (thus 434 inputs/outputs) when all extended slaves have 4 inputs and 3 outputs.
Topology and Maximum Length of AS-Interface Bus	The topology of the AS-Interface bus is flexible. It can be perfectly adapted to meet the user's needs (point to point, on line, tree structure etc.). In every case, the total length of all the branches of the bus must not exceed 100 meters (328 ft) without a repeater.

Specifications	Description
AS-Interface Bus Cycle Time	This is the cycle time between slave(s) and the master module. The AS-Interface system always transmits information, which is the same length to each slave on the bus. The AS-Interface cycle time depends on the number of active slaves connected to the bus. The scan time **t** represents the exchange time between a master and **n** active slaves (a maximum of 31 on /A or /B). So, for: ● up to 19 active slaves, **t** = 3ms ● 20 to 31 active slaves t = (1+**n**) * 0.156ms When two slaves A and B have the same address, each slave in the pair is scanned every two cycles. This means that for 31 extended address setting slaves configured in /A, + 31 extended address setting slaves configured in /B. the scan time will be 10 ms. Maximum cycle time: ● maximum 5 ms for 31 standard or extended address setting slaves, ● maximum 10 ms for 62 extended address setting slaves.
Reliability, Flexibility	The transmission process used (current modulation and Manchester code) guarantees dependable operation. The master monitors the line supply voltage and the data sent. It detects transmission errors as well as slave failures, and sends the information to the PLC. The exchange of a slave or connection of a new slave during operations does not disrupt communications with the other slaves.

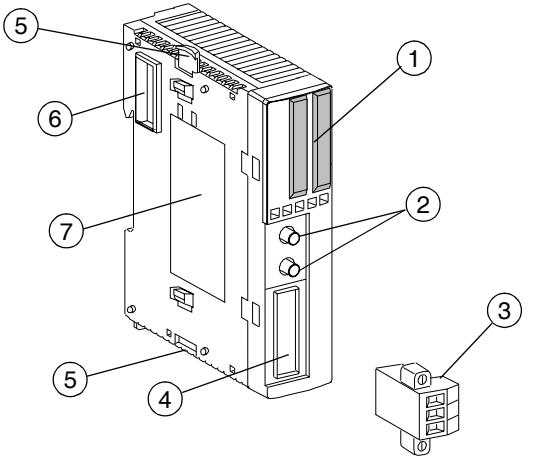
Note: When a faulty slave is replaced, the update of the replacement slave's address can be automatically carried out if the automatic addressing function is allowed on the master module.

Note: When there is mixed use of slaves with standard and extended address settings, a standard address setting slave only use an address from 1(A) to 31(A). The same address accompanied by "bank" /B can only be used by an extended address setting slave.

Parts description of an AS-Interface master module: TWDNOI10M3

Parts Description

The following diagram shows the different parts of the AS-Interface TWDNOI10M3 master module:



Legend

The module is made up of the following elements:

No.	Part	Description
1	Display	• Status display LEDs: show AS-Interface bus status, • I/O LEDs: show the I/O status of a slave specified by the address LEDs, • Address LEDs: show slave addresses.
2	Push Buttons	Allow selection of a slave's address and change of mode.
3	User terminal	Is connected to the AS-Interface cable.
4	AS-Interface cable connector	To install the terminal.
5	Latch button	Holds/releases the module from a controller.
6	Expansion Connector	Enables connection to the Twido module and connection to another I/O module.
7	Product Label	Shows the module reference and specification.

Technical specifications of the TWDNOI10M3 module and the AS-Interface V2 bus

AS-Interface V2 Bus Technical specifications:

Specification	Value
Maximum cycle time of AS-Interface bus:	• from 1 to 19 slaves = 3ms, • from 20 to 62 slaves = (1+n) x 0.156ms where n = number of active slaves. 5 ms for 31 standard or extended address setting slaves, 10 ms for 62 extended address setting slaves.
Maximum number of slaves on the bus:	31 standard address setting slaves or, 62 extended address setting slaves.
Maximum length of AS-Interface bus cables:	all branches without repeater: 100 meters (328 ft) with two repeaters: 300 meters (984 ft)
Maximum number of I/O managed by the bus	standard address setting slaves: 124 inputs + 124 outputs extended address setting slaves: 248 inputs + 186 outputs
Nominal bus supply voltage	30 VDC

AS-Interface TWDNOI10M3 module Technical specifications:

Specification	Value
Operating temperature	0 to 55°C (32°F to 131°F) operating ambient temperature
Storage temperature	-25°C to +70°C (-13°F to 158°F)
Relative humidity	from 30 to 95% Rh (non-condensing)
Pollution degree	2 (IEC60664)
Degree of protection	IP20
Corrosion immunity	Free from corrosive gases
Altitude	Operation: from 0 to 2000 m (0 to 6,560 ft) Transport: 0 to 3,000 m (0 to 9,840 ft)

Specification	Value
Resistance to Vibration	When mounted on a DIN rail: from 10 to 57 Hz amplitude 0.075 mm, from 57 to 150 Hz acceleration 9.8 ms^2 (1G), 2 hours per axis on each of three mutually perpendicular axes. When mounted on a panel surface: from 2 to 25 Hz amplitude 1.6 mm, from 25 to 100 Hz acceleration 39.2 ms^2 (4G) Lloyd's 90 min per axis on each of three mutually perpendicular axes.
Resistance to Shock	147 ms^2 (15G), 11 ms duration, 3 shocks per axis, on three mutually perpendicular axes (IEC 61131).
Allowable voltage range	from 29.5 to 31.6 VDC
Current consumed on the AS-Interface bus	Typically 65 mA / 110 mA maximum
Protection against polarity inversion on bus inputs	Yes
Connector on mother board	MSTB2.5/3-GF-5.08BK (Phoenix contact)
Average number of connector insertions/removals	100 times minimum
Power consumption	At 5 VDC: 80 mA At 24 VDC: 0 mA
Power dissipation	540 mW (24 VDC)
Weight	85 g (3 oz)

⚠ CAUTION

CONNECTION OF OTHER EXPANSION MODULES

- When an AS-Interface module is connected to a Twido module, do not connect more than five I/O expansion modules (if Twido can usually accept seven) because of the amount of heat that is generated.
- The AS-Interface master module can accept a maximum of seven analog I/O slaves; otherwise the AS-Interface system will not operate correctly.

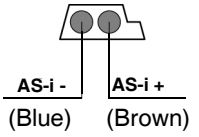
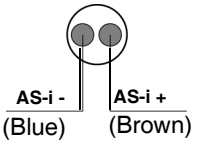
Failure to follow this instruction can result in injury or equipment damage.

Wiring and connections

Different Cable Types

The AS-Interface bus cables carry the signals and provide a 30 VDC power supply to the sensors and actuators connected to this bus.

Types of AS-Interface cables:

Cable type	Specifications	Illustration
Polarized AS-Interface ribbon cable	Jacket color: yellow Wire cross-section: 1.5 mm^2 (AWG 16)	
Standard round cable or separated cables	Wire cross-section: - stranded: from 0.5 mm^2 to 1.0 mm^2 - solids: from 0.75 mm^2 to 1.5 mm^2 (AWG: from 16 to 20)	

Procedure for Connecting the AS-Interface Master Module to the Bus

The following table describes the connection procedure:

Steps	Description
1	Remove the terminal from the module bus connector.
2	Respect the polarities of the AS-Interface cable: brown cable for the AS-i+ pole and blue cable for the AS-i– pole. Connect the cable according to the colors shown on the terminal.
3	Connect the AS-Interface ground terminal block to the DIN rail (see diagram).
4	Using a screwdriver, tighten the screws on the terminal between 0.5 to 0.6 N.m (4.4 to 5.3 lbf.in) of torque. The use of end ferrules crimped at the stranded or solid wires terminators will prevent the cable from slipping out of the terminal.
5	Insert the terminal into the module connector on the module. Using a screwdriver, tighten the mounting screws on the terminal between 0.3 to 0.5 N.m (2.6 to 4.4 lbf.in) of torque.

⚠ CAUTION

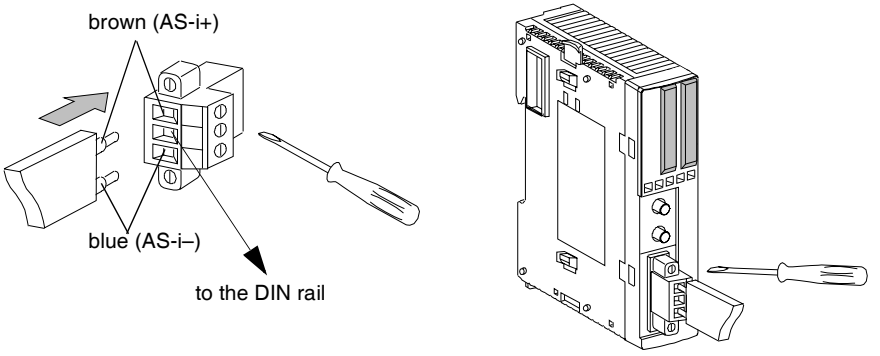
ELECTRIC SHOCK HAZARD

Do not touch the cable terminators, including immediately after the module has been switched off.

Failure to follow this instruction can result in injury or equipment damage.

Illustration of Connection

Illustration of Connection:



⚠ CAUTION

AS-INTERFACE V2 BUS SUPPLY

Use an AS-Interface SELV (Very Low Safety Voltage) supply, with nominal voltage of 30VDC.

Failure to follow this instruction can result in injury or equipment damage.

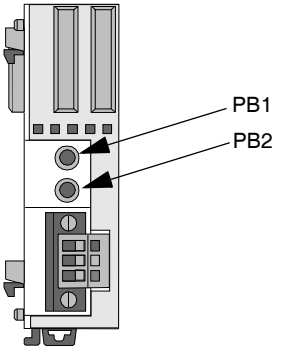
TWDNOI10M3 Operating Modes and Push Buttons

At a Glance

The actions performed using the push buttons PB1 and PB2 on the front panel of the AS-Interface module depend on the length of time for which they are pressed. A "long press" selects the operating mode and a "short press" selects the address of the slave on which you wish to perform diagnostics. If the length for which the buttons are pressed does not correspond to either of those mentioned above or the two buttons are pressed simultaneously, the status of the module remains unchanged.

Illustration

The following illustration shows the position of the buttons:



Pressing Buttons

The following table describes the function of the buttons:

Action	Description
Long press	A "long press" is effective when the button is pressed for 3 seconds or more. Use a long press to change the operating mode of the AS-Interface master.
Short press	A "short press" corresponds to pressing the button for not more than 0.5 seconds. Use a short press to change the address of the slave for which you wish to view the I/O status via the LEDs on the AS-Interface master. Pressing PB1 increments the slave address, and PB2 decrements it. When the last address 31B is reached, pressing PB1 returns you to the first address 0A.

AS-Interface Master Module Operating Modes

As soon as it is powered up, the AS-Interface module goes into online mode. The Twido module can then communicate with the AS-Interface master to allow viewing and checking of the status of each slave. Online mode consists of the three following modes:

- **Normal protected mode:**
  On power up, the AS-Interface master initially goes into this mode if no error occurs. This is the normal operating mode in which the AS-Interface master exchanges communication data with slaves connected to it.
- **Normal protected mode - Offline (software not connected):**
  To enter this mode from the previous mode, press and hold down ("long press") the push button PB2. The AS-Interface master then stops all communication with slaves allowing you to perform operations such as the initialization of the master module. In this mode, the Twido module cannot display the status of slaves. The OFF LED (See *Display of AS-Interface Master Operating Modes, p. 144*) of the AS-Interface master illuminates to indicate that the module is in Offline mode. To return to the previous mode, press and hold down ('long press") push button PB2 a second time.
- **Normal protected mode - Data Exchange Off:**
  This mode can be entered and exited only by a user program in TwidoSoft. In this mode all forms of communication with slaves is prohibited.

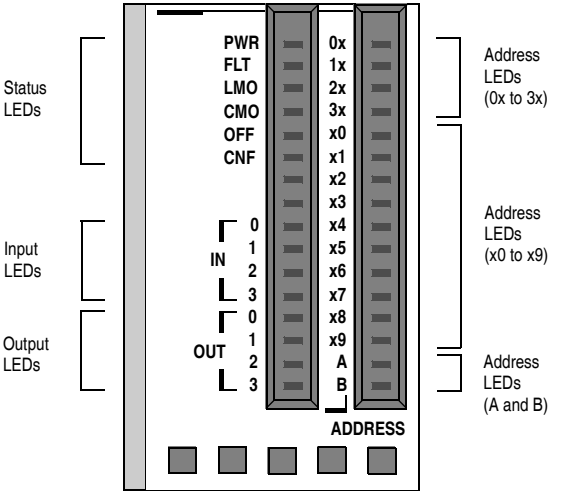
AS-Interface module TWDNOI10M3 display panel

At a Glance

The AS-Interface master module **TWDNOI10M3** is equipped with a display consisting of status LEDs, input/output LEDs and address LEDs.

Illustration

Illustration of display panel:



Display of Module Status

Module status is displayed by the status LEDs on the module which provide information depending on their state (indicator extinguished or illuminated) on the module operating mode.
Status LED descriptions

LED	Status	Description
PWR	●	Indicates that the AS-Interface module is not powered up.
	○	Indicates that insufficient power is being delivered to the AS-Interface module.
FLT	●	Indicates that the configuration loaded onto the AS-Interface master is not correct or that an error has occurred on the AS-Interface bus.
	○	Module OK.
LMO	○	Indicates that the module is not in offline mode (the module is online from power up). Note: Flickers on power up.
CMO	●	Indicates that the module is in online mode.
OFF	●	Indicates that the module is in offline normal protected mode.
	○	Indicates that the module is in another operating mode.
CNF	○	This indicator is no longer used. Note: Flickers on power up.
○ Extinguished ● Illuminated		

Display of AS-Interface Master Operating Modes

The operating modes of the AS-Interface module can be changed using the push buttons or TwidoSoft programming software. The status LEDs also allow you to determine what mode the AS-Interface module is in.
Mode display table

Operating modes	PWR	FLT	LMO	CMO	OFF	CNF
Normal Protected Mode	●	○	○	●	○	○
Normal Protected Mode (Offline)	●	●	○	●	●	○
Normal Protected Mode (Data Exchange OFF)	●	●	○	●	○	○
○ Extinguished ● Illuminated						

Diagnostics of the AS-Interface Bus

The input/output LEDs and address LEDs can be used to view slaves on the AS-Interface bus and determine their operating status.
Diagnostics table:

State of address LEDs	State of IN/ OUT LEDs	Description
●	● or ○	There is a slave at this address and its inputs/outputs are on and active.
●	⊠	There is a slave at this address, but an error has occurred.
⊠	○	No slave is assigned to this address.
○	○	Communication on the AS-Interface bus has been interrupted because no power is being supplied or because the AS-Interface module is offline normal protected mode.
○ Extinguished	⊠ Flashing	● Illuminated

The slave address is selected using the buttons PB1 and PB2. An address with an assigned slave can be read using the address LEDs as shown in the following example:
If LEDS 2x, x5 and B are illuminated, this indicates that there is a slave assigned to address 25B.

2.7 CANopen fieldbus master module

At a Glance

Introduction

This section provides a review of the CANopen fieldbus, provides a description of the module, and describes the specifications and use of the CANopen master module**TWDNCO1M**.

What's in this Section?

This section contains the following topics:

About the CANopen Fieldbus

Introduction

Originally developed for automotive vehicle borne systems, the CAN communication bus is now used in many areas, such as:
- transport,
- moving part devices,
- medical devices,
- building,
- industrial control.

The advantages of the CAN system are:
- the bus allocation system,
- error detection,
- data exchange reliability.

Master/slave structure

The CAN bus has a master/slave structure for bus management.
The master manages
- slave initialization,
- communication errors,
- slave status.

Peer to peer communication

Communications on the bus are made **peer to peer**; at any moment, each device can send a request on the bus and the relevant devices reply. The priority of the requests circulating on the bus is determined by an identifier at individual message level.

CAN identifiers

Explicit exchanges of CAN PDUs at link level use extended identifiers over 29 bits (CAN standard V2.0B).
11 bit identifiers (CAN standard V2.0A) can only be used for sending and receiving.

CANopen Fieldbus Topology

At a Glance

The CANopen architecture of a Twido system consists of:

- a Twido PLC (compact base or modular base)[1],
- a CANopen fieldbus master module (TWDNCO1M module) installed on the Twido PLC's expansion bus[2],
- CANopen slave devices[3,4].

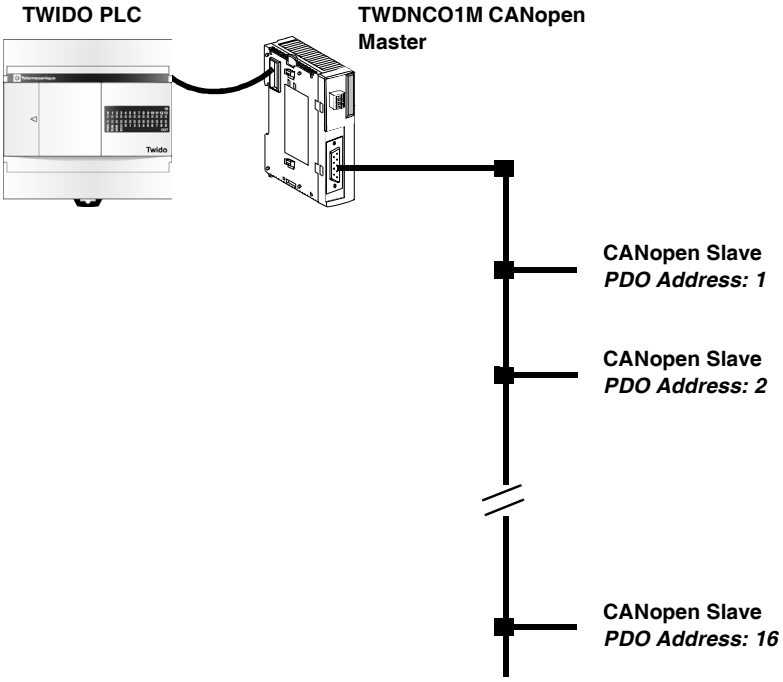
Note:

1. The TWDNCO1M CANopen master module is supported by the following Twido base controllers:
   - Compact bases: TWDLC•A24DRF and TWDLCA•40DRF series
   - All modular bases: TWDLMDA20••• and TWDLMDA40••• series
2. Only 1 TWDNCO1M CANopen master module can be installed on the Twido system expansion bus.
3. The TWDNCO1M CANopen master module can manage up to 16 CAN slave devices on a single bus segment.
4. The TWDNCO1M CANopen fieldbus does not support extended addressing for CAN slave devices.

The baud rate of the bus depends on its length and the cable type used (See *Cable Length and Transmission Speed, p. 149*).

Twido CANopen Fieldbus Topology

The following figure shows the Twido CANopen fieldbus topology:



Cable Length and Transmission Speed

At a Glance

The TWDNCO1M CANopen master allows up to 16 slave devices on the bus. Transmission speed depends strictly on the bus length and the type of cable used. The following two tables enable you to evaluate authorized values.

Baud Rate versus Cable Length

The following table describes the relationship between the maximum transmission speed and the bus length (on a single CAN segment without repeater).

Maximum transmission baud rate	Bus length
1 Mbit/s	25 m (82 ft)
800 Kbit/s	50 m (164 ft)
500 Kbit/s	100 m (328 ft)
250 Kbit/s	250 m (820 ft)
125 Kbit/s	500 m (1,640 ft)
50 Kbit/s	600 m (1,968 ft)
20 Kbit/s	800 m (2,624 ft)
10 Kbit/s	1,000 m (3,280 ft)

Baud Rate and Cable Length versus Cable Impedance and Type

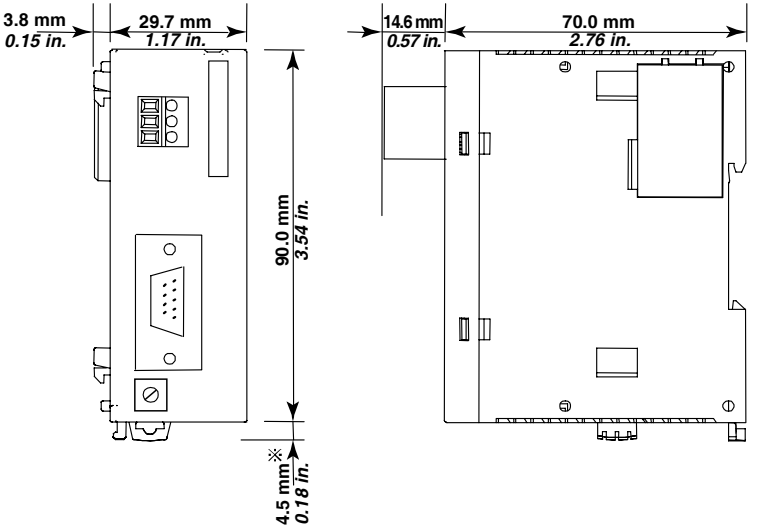
The following table describes the relationship between the maximum transmission speed for a given bus length in relation to the type of cable used (cable gauge and impedance).

Maximum baud rate	Bus length	Cable impedance	Cable section/gauge
1 Mbit/s @ 40 m (131 ft)	0 - 40 m (0 - 131 ft)	70 mΩ/m (21.3 mΩ/ft)	0.25 - 0.34 mm^2, (e.g. AWG 24, AWG 22)
500 Kbit/s @ 100 m (328 ft)	40 - 300 m (131 - 984 ft)	< 60 mΩ/m (< 18.3 mΩ/ft)	0.34 - 0.6 mm^2, (e.g. AWG 22, AWG 20)
125 Kbit/s @ 500 m (1,640 ft)	300 - 600 m (984 - 1,968 ft)	< 40 mΩ/m (< 12.2 mΩ/ft)	0.5 - 0.6 mm^2, (e.g. AWG 20)
50 Kbit/s @ 600 m (1,968 ft)	600 - 1000 m (1,968 - 3,280 ft)	< 26 mΩ/m (< 7.9 mΩ/ft)	0.75 - 0.8 mm^2, (e.g. AWG 18)

Dimensions of the CANopen master module: TWDNCO1M

CANopen Master Module Dimensions

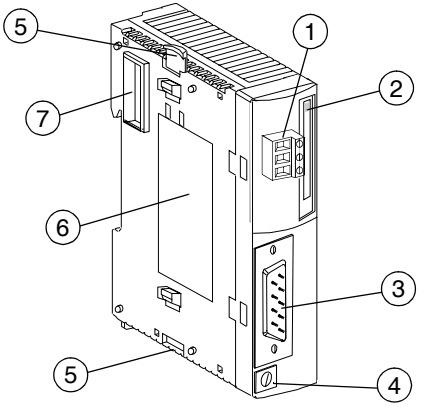
The following diagram shows the dimensions of the CANopen Master module TWDNCO1M:



Parts description of a CANopen master module: TWDNCO1M

Parts Description

The following diagram shows the different parts of the CANopen TWDNCO1M master module:



Legend

The module is made up of the following elements:

No.	Part	Description
1	**Power supply connector**	**3-point connector used to connect a 24 VDC power supply.**
2	CANopen status LED	Shows the CANopen bus status. (See *CANopen Status LED, p. 260*.)
3	DSUB (DB9) terminal	To connect the CANopen interface cable.
4	PE ground	Protective earth (PE) ground (M3 screw terminal).
5	Latch button	Holds/releases the module from a controller.
6	Module name	Shows the module reference and specification.
7	Expansion Connector	Enables connection to the Twido module and connection to another I/O module.

Technical specifications of the TWDNCO1M module and the CANopen fieldbus

CANopen Fieldbus

Technical specifications:

Specification	Value
Maximum number of slaves on the bus	16 CANopen slave devices, not to exceed a total of 16 TPDOs and 16 RPDOs over the CAN bus.
Maximum length of CANopen fieldbus cables	According to the CAN specification (see *Cable Length and Transmission Speed, p. 149*.)
Maximum number of PDOs managed by the bus	16 TPDOs + 16 RPDOs

CANopen TWDNCO1M module

Technical specifications:

Specification	Value
Operating temperature	0 to 55°C (32°F to 131°F) operating ambient temperature
Storage temperature	-40°C to +70°C (-40°F to 158°F)
Relative humidity	from 10 to 95% Rh (non-condensing)
Pollution degree	Housing:3 (IEC60664-1) PCB:2 (IEC60664-1)
Degree of protection	IP20
Corrosion immunity	Free from corrosive gases
Altitude	Operation: from 0 to 2000 m (0 to 6,565 ft) Transport: 0 to 3,000 m (0 to 9,840 ft)
Resistance to Vibration	When mounted on a DIN rail: from 10 to 57 Hz amplitude 0.75 mm, from 57 to 150 Hz acceleration 9.8 ms^2 (1G), 2 hours per axis on each of three mutually perpendicular axes. When mounted on a panel surface: from 2 to 25 Hz amplitude 1.6 mm, from 25 to 100 Hz acceleration 9.8 ms^2 (1G) Lloyd's 90 min per axis on each of three mutually perpendicular axes.
Resistance to Shock	147 ms^2 (15G), 11 ms duration, 3 shocks per axis, on three mutually perpendicular axes (IEC 61131).
Allowable voltage range	from 19.2 to 30 VDC
Protection against polarity inversion on bus inputs	Yes
CANopen fieldbus interface connector	D SUB (DB9)

Specification	Value
Power consumption	At 5 VDC: 50 mA (INTERNAL BUS) At 24 VDC: 50 mA (EXTERNAL POWER SUPPLY)
Power dissipation	1.2W (@24 VDC)
Weight	100 g (3.5 oz.)
Overall dimensions	29.7mm(W) x 84.6mm(H) x 90mm(D) 1.17in(W) x 3.33in(H) x 3.54in(D)

⚠ CAUTION

CONNECTION OF OTHER EXPANSION MODULES

- When a CANopen master module is connected to a Twido module, do not connect more than 6 additional I/O expansion modules on the Twido internal bus (not to exceed a maximum of 450 mA of current on the Twido internal bus).
- The CANopen master module can accept a maximum of sixteen CAN slave devices (not to exceed a total of 16 TPDOs and 16 RPDOs over the CAN bus); otherwise the CANopen system will not operate correctly.

Failure to follow this instruction can result in injury or equipment damage.

CANopen Wiring and Connections

Introduction

This sub-section describes how to connect the CANopen power supply and the CANopen bus.

Procedure for Connecting the CANopen Power Supply

The following procedure describes how to connect the 24 VDC power supply to the CANopen power supply terminal:

Steps	Description
1	Remove the power supply connector from the CANopen master module.
2	Plug the external power supply leads into the removable connector, observing the correct polarity as indicated by the connection diagram below.
3	Using a screwdriver, tighten the screws on the removable connector to 0.2 N·m (1.77 lbf·in) of torque. The use of end ferrules crimped at the multifilament or solid wires terminators will prevent the cable from slipping out of the terminal.
4	Place the removable connector back onto the CANopen master module.
5	Connect the CANopen protective earth (PE) ground screw terminal to the proper earth ground in your facility.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Do not use the Twido controller's 24VDC sensor power supply to provide +24VDC power to the CANopen module for this will make the photocoupler isolation inoperative.
- Use only dedicated external power supply to provide power to the CANopen module.

Failure to follow this instruction can result in death, serious injury, or equipment damage.

⚠ CAUTION

HAZARD OF ELECTRIC SHOCK

Do not touch the cable terminators, including immediately after the module has been switched off.

Failure to follow this instruction can result in injury or equipment damage.

Procedure for Turning On the CANopen Devices

Turn on your equipment connected to the CANopen master module in the following order:

Step	Action
1	Turn on all CANopen slave devices connected to the CANopen master module.
2	Turn on the CANopen master module by applying the specified CANopen power supply. (See *Procedure for Connecting the CANopen Power Supply, p. 154*) **Note:** Allow sufficient time for the CANopen master module to complete its power-up sequence before you proceed to the next step.
3	Turn on the Twido controller connected to the CANopen master module.
Please follow the above power-on sequence to ensure that all equipment present on the CANopen bus are detected correctly by the Twido controller.	

Power Supply Connector Pin Assignment

The following figure illustrates the pin assignment for the TwidoPort's CANopen power supply connector:

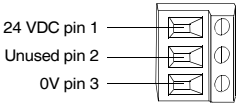
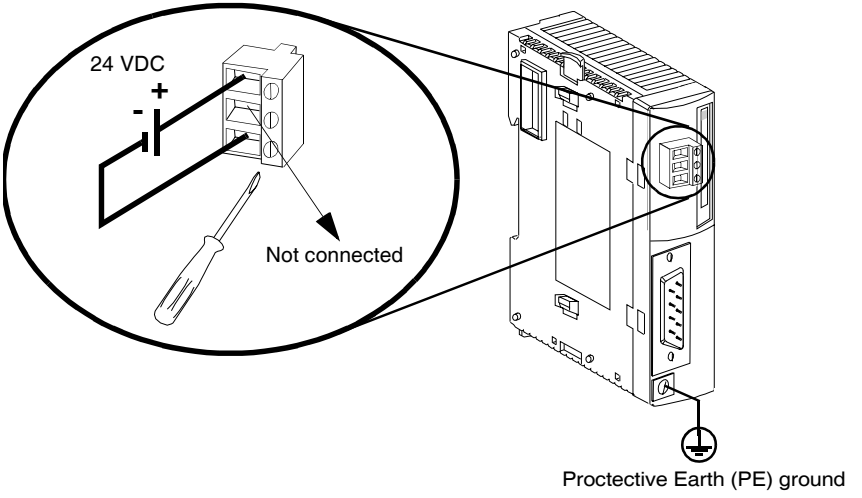


Illustration of Power Supply Connection

Illustration of power supply connection:



Proper Grounding

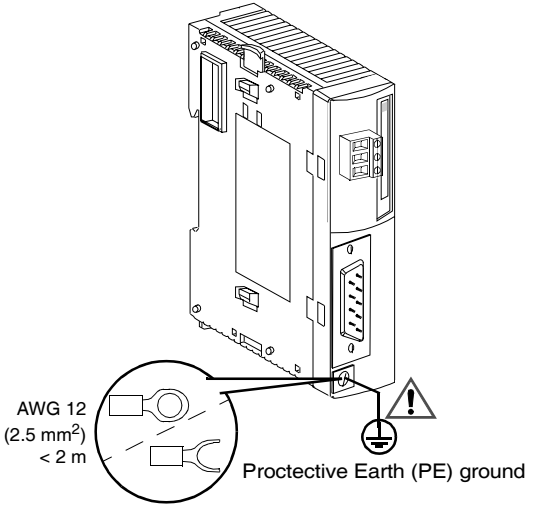
⚠ WARNING

HAZARD OF ELECTRIC SHOCK

The grounding screw terminal (PE) must be used to provide protective earth at all times. Make sure that PE is attached before connecting or disconnecting the D-SUB CAN fieldbus cable the device.

Failure to follow this instruction can result in death, serious injury, or equipment damage.

The following figure describes the grounding screw terminal (PE):



Ground Cable

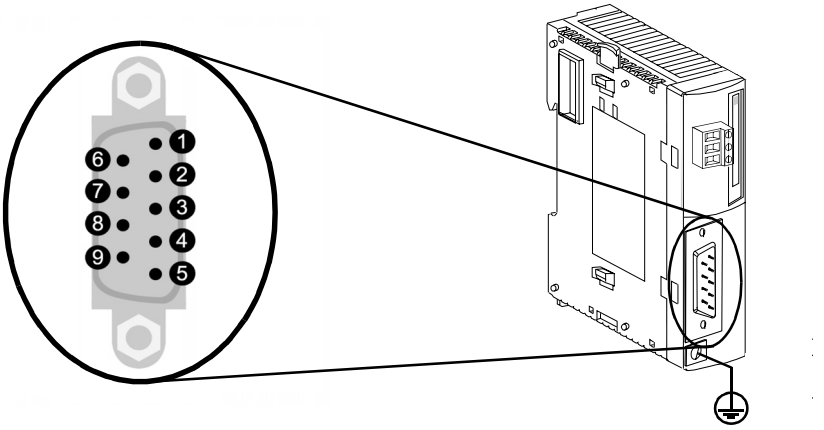
The PE ground must be capable of supporting 30 A of current for 2 minutes and have no more than 100 mΩ of resistance. The recommended PE wire size is AWG #12 (2.5 mm^2). The maximum allowable length of the wire at AWG #12 is less than 2 meters. Use the shortest wire length possible.

PE Ground Screw Terminal

Using a screwdriver, tighten the screw on the PE ground terminal to a 0.5 N·m (4.4 lbf·in) torque.

Connection to the CANopen Field Bus

The CANopen field bus connector is located in the lower pane of the master module front-panel:



We recommend you use a D-SUB 9-pin female metal connector compliant with standard DIN 41652, or with the corresponding international standard to connect the network field bus cable to the master module. The connection must conform to the following pin assignment:

Contacts	Signal	Description
1	Unused	Reserved
2	CAN_L	CAN-L bus line (low dominant)
3	CAN_GND	CAN earth
4	Unused	Reserved
5	CAN_SHLD	Optional CAN shielding
6	GND	Optional ground
7	CAN_H	CAN-H bus line (high dominant)
8	Unused	Reserved
9	CAN_V+	NC (not connected)
Note 1: The contacts pinout corresponds to the legend of the above figure. **Note 2:** Reserved contacts will be used in a future specification.		

CANopen Network Connectors and Cables

The branch cable between the field bus and the master module must have a female connector complying with the above contact assignment diagram. The CANopen network cable is a shielded twisted double-pair cable complying with the CANopen standard CiA DR-303-1. No wire interruption is authorized in the bus cable. This enables the reserved contacts to be used in a future specification.

2.8 Communication Options

At a Glance

Introduction

This section provides an overview, parts description, and specifications of the communication options.

What's in this Section?

This section contains the following topics:

Overview of Communication Adapters and Expansion Modules

Introduction

The following section provides an overview of the TWDNAC232D, TWDNAC485D, and TWDNAC485T communication adapters and the TWDNOZ232D, TWDNOZ485D, and TWDNOZ485T communication expansion modules.

Overview

All Twido controllers have one RS485 communication serial port 1. Moreover, TWDLC•A16DRF, TWDLC•A24DRF and TWDLCA•40DRF controllers have a serial port 2 connector for an optional second RS485 or RS232 serial port. An optional communication adapter (TWDNAC232D, TWDNAC485D, and TWDNAC485T) is available to install on the serial port 2 connector. Note that the TWDLCAA10DRF series does not have a serial port 2 connector.

In addition, the TWDLCAE40DRF series compact controllers have a built-in RJ-45 Ethernet network communications port.

A communication expansion module (TWDNOZ232D, TWDNOZ485D, and TWDNOZ485T) is available to attach to any Modular controller for an optional second RS485 or RS232 serial port. Also, an operator display expansion module (TWDXCPODM) is available to attach to a Modular controller where an optional communication adapter (TWDNAC232D, TWDNAC485D, and TWDNAC485T) can be installed to the serial port 2 connector on the operator display expansion module.

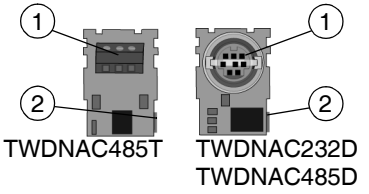
Parts Description of Communication Adapters and Expansion Modules

Introduction

The following section describes the parts of the TWDNAC232D, TWDNAC485D, and TWDNAC485T communication adapters and the TWDNOZ232D, TWDNOZ485D, and TWDNOZ485T communication expansion modules.

Parts Description of a Communication Adapter

The following figure shows the parts of the TWDNAC232D, TWDNAC485D, and TWDNAC485T communication adapters.

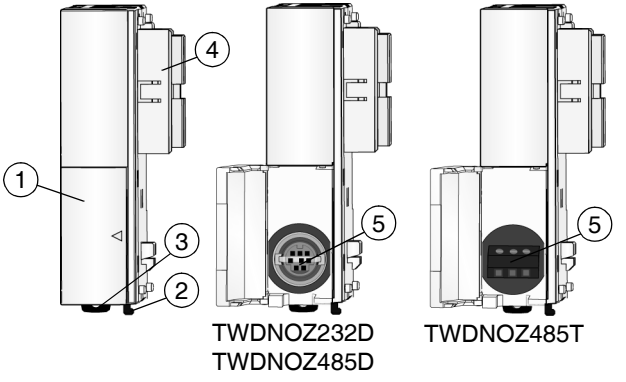


Legend

Label	Part	Description
1	Serial port 2	Adds an optional second RS485 or RS232 serial port.
2	Connector	Connects to the serial port 2 connector on TWDXCPODM operator display expansion module or TWDLCAA16DRF and TWDLCAA24DRF controllers.

Parts Description of a Communication Expansion Module

The following figure shows the parts of the TWDNOZ232D, TWDNOZ485D, and TWDNOZ485T communication expansion modules.



Legend

Label	Part	Description
1	Hinged door	Opens to access the serial port 2.
2	Clamp	Secures the module to a DIN rail.
3	Latch button	Holds/releases the module from a controller.
4	Communication connector	Connects to a Modular controller.
5	Serial port 2	Adds an optional second RS485 or RS232 serial port to a Modular controller.

Specifications for Communication Adapters and Expansion Modules

Introduction

This section presents the specifications for the TWDNAC232D, TWDNAC485D, and TWDNAC485T communication adapters and the TWDNOZ232D, TWDNOZ485D, and TWDNOZ485T communication expansion modules.

Communication Adapter and Expansion Module Specifications

The following table describes the communication adapter and expansion module specifications.

Reference number	**TWDNAC232D TWDNOZ232D**	**TWDNAC485D TWDNOZ485D**	**TWDNAC485T TWDNOZ485T**
Standards	RS232	RS485	RS485
Maximum baud rate	19,200 bps	PC Link: 19,200 bps Remote Link: 38,400 bps	PC Link: 19,200 bps Remote Link: 38,400 bps
Communication Modbus (RTU master/slave)	Possible	Possible	Possible
ASCII communication	Possible	Possible	Possible
Remote link communication:	Not possible	7 links possible	7 links possible
Maximum cable length	Maximum distance between the base controller and the remote controller: 10 m (32.8 ft)	Maximum distance between the base controller and the remote controller: 200 m (656 ft)	Maximum distance between the base controller and the remote controller: 200 m (656 ft)
Isolation between internal circuit and communication port	Not isolated	Not isolated	Not isolated

2.9 Operator Display Options

At a Glance

Introduction

This section provides an overview, parts description, and specifications of the operator display options.

What's in this Section?

This section contains the following topics:

Overview of Operator Display Modules and Expansion Modules

Introduction

The following section provides an overview of the TWDXCPODC operator display module and the TWDXCPODM operator display expansion module.

Overview

The operator display is an optional module that can be added to any of the controllers. It is installed into a Compact controller as a operator display module (TWDXCPODC) and it is assembled to a Modular controller using the operator display expansion module (TWDXCPODM). See *How to Install the Operator Display Module and Operator Display Expansion Module, p. 213*.

The operator display provides the following services:
- Displays the controller state information
- Allows the user to control the controller
- Allows the user to monitor and tune application data objects

The operator display has two states:
- Display state - Displays data
- Edit state - Allows the user to change data

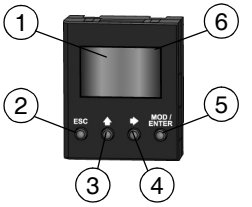
Parts Description of Operator Display Module and Expansion Module

Introduction

The following section describes the parts of the TWDXCPODC operator display module and the TWDXCPODM operator display expansion module.

Parts Description of a Operator Display Module

The following figure shows the parts of the TWDXCPODC operator display module.

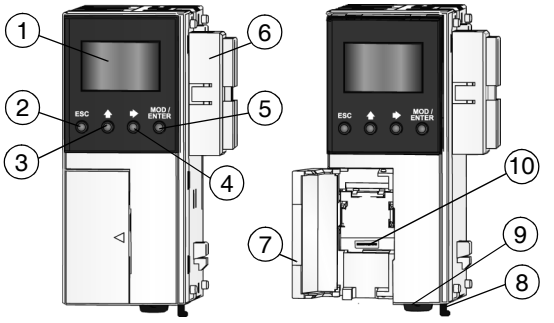


Legend

Label	Part	Description
1	Display screen	Shows menus, operands, and data.
2	ESC button	In Edit state - Returns to the previous display state and rejects changes made by the user.
3	Up arrow button	In Edit state - Changes the current edit element to the next value.
4	Right arrow button	In Display state - Advances to the next display state. In Edit state - Advances to the next editing element. The current editing element blinks.
5	MOD/ENTER button	In Display state - Works in MOD function, goes to the corresponding edit state. In Edit state - Works in ENTER function, returns to previous display state and accepts changes made by the user.
6	Operator display connector	Connects to the Compact controller.

Parts Description of a Operator Display Expansion Module

The following figure shows the parts of the TWDXCPODM operator display expansion module.



Legend

Label	Part	Description
1	Display screen	Shows menus, operands, and data.
2	ESC button	In Edit state - Returns to the previous display state and rejects changes made by the user.
3	Up arrow button	In Edit state - Changes the current edit element to the next value.
4	Right arrow button	In Display state - Advances to the next display state. In Edit state - Advances to the next editing element. The current editing element blinks.
5	MOD/ENTER button	In Display state - Works in MOD function, goes to the corresponding edit state. In Edit state - Works in ENTER function, returns to previous display state and accepts changes made by the user.
6	Operator display connector	Connects to a Modular controller.
7	Hinged door	Opens to access the serial port 2.
8	Latch button	Holds/releases the module from a controller.
9	Clamp	Secures the module to a DIN rail.
10	Serial port 2 connector	Connects to the connector on an optional TWDNAC232D, TWDNAC485D, or TWDNAC485T communication adapter.

Specifications for Operator Display Modules and Expansion Modules

Introduction

This section is specifications for the TWDXCPODC operator display module and the TWDXCPODM operator display expansion module.

Operator Display Module Specifications

The following table describes the operator display module specifications.

Part Number	TWDXCPODC
Power voltage	5 VDC (supplied from the controller)
Internal current draw	200 mA DC
Weight	20 g (0.7 oz)

Operator Display Expansion Module Specifications

The following table describes the operator display expansion module specifications.

Part Number	TWDXCPODM
Weight	78 g (2.75 oz)
Internal current draw	200 mA DC

2.10 Options

At a Glance

Introduction

This section provides an overview and specifications of the options.

What's in this Section?

This section contains the following topics:

Overview of the Options

Introduction

The following section provides an overview of the TWDXCPMFK32 and TWDXCPMFK64 memory cartridges, the TWDXCPRTC Real Time Clock (RTC) cartridge, and the TWDXSM6, TWDXSM9, and TWDXSM14 input simulators.

Overview of the Memory Cartridges

There are two optional memory cartridges, 32 KB (TWDXCPMFK32) and 64 KB (TWDXCPMFK64), available. The memory cartridges provide additional memory for application storage. The memory cartridges are used to:

- Provide a removable backup of the application.
- Load an application into a controller if certain conditions exist.
- Increase the program memory capacity.

The following table presents the available memory cartridge for each controller.

Memory Cartridge	Compact 10 I/O	Compact 16 I/O	Compact 24 I/O	Compact 40 I/O	20 I/O modular	40 I/O modular
TWDXCPMFK32	yes	yes	yes	yes	yes	yes
TWDXCPMFK64	no	no	no	yes	yes	yes

The TWDXCPMFK32 memory cartridge is for back up only. The TWDXCPMFK64 memory cartridge is for back up and expansion.

Overview of the Real Time Clock (RTC) Cartridge

An optional Real Time Clock cartridge (TWDXCPRTC) is available for all controllers. (Note that 40 I/O compact controllers have RTC onboard.)
The Real Time Clock cartridge provides the controller with the current time and date. The RTC is required for the Schedule Blocks to operate.
When the controller is powered down, the Real Time Clock (RTC) will keep time for 1000 hours at 25 °C (77°F) or 300 hours at 55°C (131°F) when using a fully charged battery.

Overview of the Input Simulators

There are three input simulators: 6, 9, and 14 point. These are used only on the three Compact controllers. Used for debugging, you can control the inputs to test your application logic.

Specifications for the Options

Introduction

This section is specifications for the TWDXCPMFK32 and TWDXCPMFK64 memory cartridges and the TWDXCPRTC RTC cartridge.

Memory Cartridge Specifications

The following table describes the memory cartridge specifications.

Memory Type	EEPROM
Accessible memory capacity	32 KB: TWDXCPMFK32 64 KB: TWDXCPMFK64
Hardware for storing data	Twido controller
Software for storing data	Twido Soft
Quantity of stored programs	One user program is stored on one memory cartridge.
Program execution priority	When a memory cartridge is installed and enabled, the external user program will be loaded and executed if it differs from the internal program.

Real Time Clock Cartridge Specifications

The following table describes the Real Time Clock cartridge specifications.

Accuracy	30 s/month (typical) at 25°C (77°F)
Backup duration	Approximately 30 days (typical) at 25°C (77°F) after backup battery fully charged
Battery	Lithium secondary battery
Charging time	Approximately 10 hours for charging from 0% to 90% of full charge
Replaceable	Not possible

2.11 The ConneXium TwidoPort Ethernet Interface Module

At a Glance

Introduction

This section provides an overview and describes external features and specifications of the 499TWD01100 ConneXium TwidoPort Ethernet interface module.

What's in this Section?

This section contains the following topics:

Overview of the ConneXium TwidoPort Ethernet Interface Module

Introduction

The ConneXium TwidoPort adds Ethernet connectivity to Telemecanique's Twido product line. It is the gateway between a single Twido Modbus/RTU (RS-485) device and the physical layer of Modbus/TCP networks in slave mode.
TwidoPort does not require a separate power supply because it gets power from the Twido controller through its serial port.
This gateway module supports slave mode only.

Package Contents

The ConneXium TwidoPort 499TWD01100 package contains:
- One 499TWD01100 TwidoPort module
- One Quick Reference Guide
- One adapter cable (mini-din, RJ-45 male, 50 cm length)

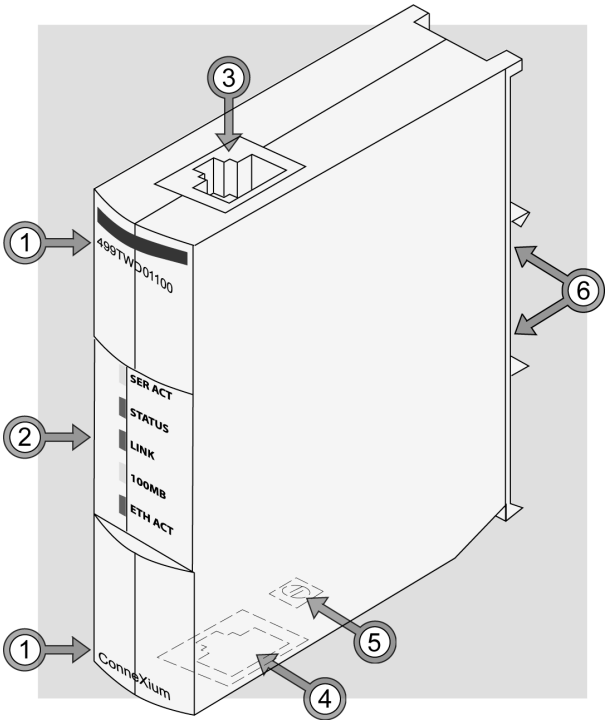
Product Designation

The 499TWD01100 ConneXium TwidoPort Ethernet interface module will be referred to as **TwidoPort** in the remainder of this document.

TwidoPort's External Features

External Features

The following figure shows the parts of the 499TWD01100 TwidoPort Ethernet interface module.



Legend

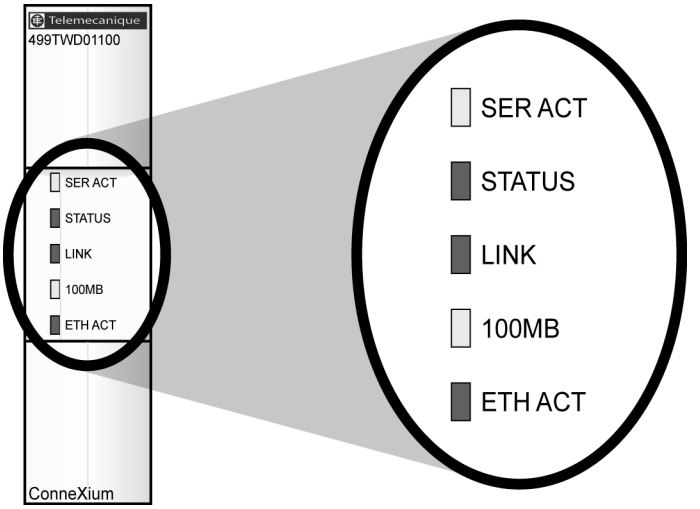
The following table describes the external features of the 499TWD01100 TwidoPort Ethernet interface module.

Feature		Function
1	Model number Model name	499TWD01100 ConneXium
2	LED display	visual indications of TwidoPort's operating status
3	RJ-45 modular jack	power and communications connection to Twido's RS-485 port (over the supplied cable)
4	RJ-45 modular jack	connection to TCP/IP over Ethernet cable (not supplied)
5	PE ground	protective earth (PE) ground (M3 screw terminal)
6	DIN rail connector	for DIN rail mounting

TwidoPort's LED-Panel Description

LED-Panel

The five LEDs implemented in TwidoPort are visual indications of the operating status of the module:



Description of the Communication LEDs

This table describes the condition(s), colors, and blink patterns that indicate the operating status of the module:

Label	Meaning	Pattern	Indication(s)
SER ACT (yellow)	serial active	on	serial activity
		off	no serial activity
STATUS (green)	module status	on	normal condition
		off	abnormal condition
		blink: 2	invalid MAC address
		blink: 3	link not connected
		blink: 4	duplicate IP connection
		blink: 5	attempting to get IP condition through BootP
		blink: 6	default IP condition
		blink: 7	kernel mode
LINK (green)	Ethernet link	on	link is active
		off	link is not active
100MB (yellow)	speed	on	100 MB/sec (half duplex only, no full duplex support)
		off	10 MB/sec (full/half duplex)
ETH ACT (green)	Ethernet activity	on	Ethernet is active
		off	Ethernet is not active

Note: During the autobaud process, the serial activity LED blinks at a 50Hz rate and appears to be on solid. When the serial activity LED goes off, the autobaud process is complete.

Using the LED Table

Individual blinks are approximately 200 ms. There is a one-second interval between blink sequences. For example:

- blinking—blinks steadily, alternating between 200 ms on and 200 ms off
- blink 1—blinks once (200 ms), then 1 second off
- blink 2—blinks twice (200 ms on, 200 ms off, 200 ms on), then one second off, etc.

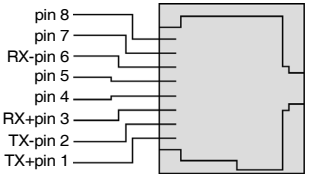
TwidoPort's Wiring

Ethernet Wiring

TwidoPort contains an RJ-45 10/100 Mbps port. The port negotiates speed to the fastest condition that the end device can support.

Ethernet Connector Pin Assignment

The following figure illustrates the pin assignment for TwidoPort's Ethernet port:



General Specifications

Environmental

Specification	Specified value
operating temperature	0 to 55 °C (32 °F to 131 °F)
storage temperature	-40 °C to +70 °C (-40 °F to 158 °F)
relative humidity	10 to 95% (non-condensing)
pollution degree	2
degree of protection	IP20
corrosion immunity	free from corrosive gases
altitude	operation: 0 to 2,000 m (0 to 6,565 ft) storage: 0 to 3,040 m (0 to 10,000 ft)
vibration resistance	When mounted on a DIN rail: ● 10 to 57 Hz: 0.075 mm double amplitude (peak-to-peak) displacement. ● 57 to 100 Hz: 9.8 m ms2 (1g) constant acceleration. ● duration: 10 sweeps at 1 octave/min on each of three mutually perpendicular axes.
shock resistance	147 ms2 (15g), 11 ms duration, 3 shocks per axis, on three mutually perpendicular axes (IEC 61131-2)
weight	< 200g (7 oz)

Electrical

Specification	Specified value
max. current draw	180 mA @ 5 VDC
supply voltage	5 +/- 0.5 VDC

Agency Certification

Specification	
UL 508, UL 1604 hazardous class 1, Div. 2, groups A, B, C, D	
CSA C22.2 No. 142	
CSA C22.2 No. 213 hazardous class 1, Div. 2, groups A, B, C, D	
CE	EN 61131-2
	EN 55011 (class A)
(IEC 61000-4-2) Electrostatic Discharge (ESD)	4KV contact
	4KV air
(IEC 61000-4-3) RFI Immunity (RS)	80 MHz to 2.0 GHz 10V/m, 1 KHz 80% AM
(IEC 61000-4-4) Fast Transients (EFT)	communications ports/cables +/- 1KV
(IEC 61000-4-5) surge withstand capability (transients)	1.2 x 50 μs
	shielded communications cable 1KVCM 2Ω
EN61000-4-6	3Vrms 150KHz to 80 MHz, 1 KHz 80% AM
flammability	connector: UL 94V-0
	enclosure: UL 94V-0
Note: This product complies with the requirements of EN 61132-3: 2003.	

2.12 Telefast® Pre-Wired Systems for Twido

At a Glance

Introduction

This section provides an overview, specifications and base wiring schematics of the Telefast® pre-wired systems for Twido.

What's in this Section?

This section contains the following topics:

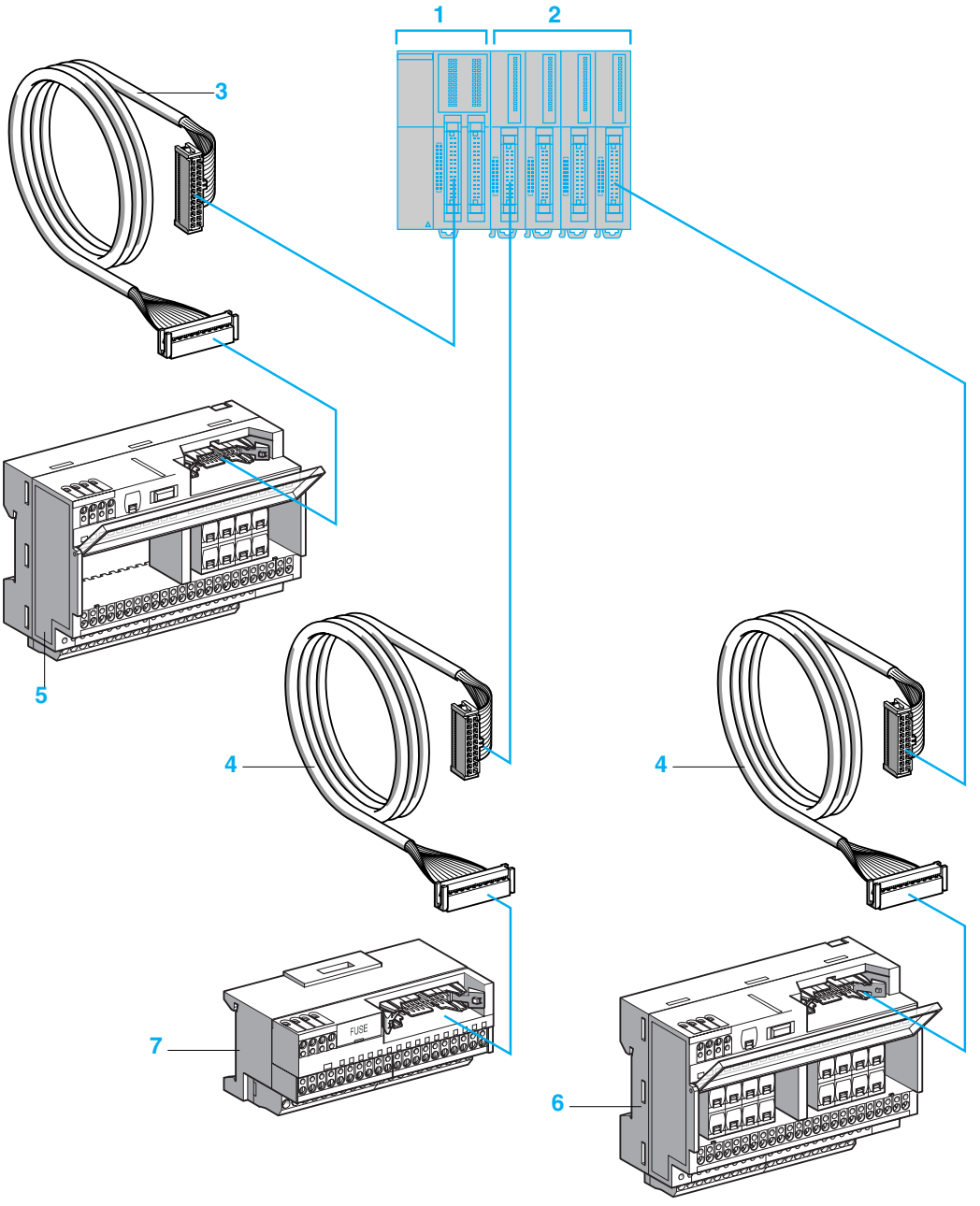
Overview of the Telefast® Pre-Wired System for Twido

Introduction

The following section provides an overview of the ABE 7B20MPN20, ABE 7B20MPN22, ABE 7B20MRM20, ABE 7E16EPN20, ABE 7E16SPN20, ABE 7E16SPN22 and ABE 7E16SRM20 Telefast® pre-wired systems for Twido.

Illustration

The following illustration shows the Telefast® system for Twido:



Legend

Telefast system parts shown in the previous illustration are listed below:

1. Modular base controller with 26-way HE 10 connectors. The modular sizes available are 20 or 40 I/O.
2. Input and output modules with 20-way HE 10 connectors. The modular sizes available are 16 or 32 I/O.
3. Cable (ABF T26B••0) equipped with a 26-way HE 10 connector at each end. This cable is available in 0.5, 1 and 2 meter lengths (AWG 28/0.08 mm^2).
4. Cable (ABF T20E••0) equipped with a 20-way HE 10 connector at each end. This cable is available in 0.5, 1, 2 and 3 meter lengths (AWG 28/0.08 mm^2).
5. 20 channel sub-base (ABE 7B20MPN2• or ABE 7B20MR20) for modular base controllers.
6. 16 channel sub-base (ABE 7E16SPN22 or ABE 7E16SRM20) for output extension modules.
7. 16 channel sub-base (ABE 7E16EPN20 or ABE 7E16SPN20) for input or output extension modules.

Compatibility Table

The following table describes compatibility between Twido (modular bases and I/O modules) and Telefast® components (bases and cables):

		Modular base controllers	Discrete I/O modules	
		Inputs/outputs	Inputs	Outputs
Incorporated in Twido programmable controllers		**TWD LMDA 20DTK (12 I/8 O)** **TWD LMDA 40DTK** (24 I/16 O)	**TWD DDI 16DK (16 I)** **TWD DDI 32DK** (32 I)	**TWD DDO 16TK** (16 O) **TWD DDO 32TK** (32 O)
Terminal block types		HE 10 connector, 26-way	HE 10 connector, 20-way	
Connection to Twido programmable controller		**ABF T26B••0** (HE 10, 26-way)	**ABF T20E••0** (HE 10, 20-way)	
Passive connection sub-bases				
20 channels	**ABE 7B20MPN2•**	Yes		
16 channels	**ABE 7E16EPN20**		Yes	
	ABE 7E16SPN2•			Yes
Output adapter bases				
20 channel	**ABE 7B20MRM20**	Yes		
16 channels	**ABE 7E16SRM20**			Yes

Specifications for the Telefast® Bases

Introduction

This section provides specifications for the Telefast® bases.
See Catalog 8501CT9801, "Advantys, TeleFast® pre-wired system for Twido" for more specifications on these Telefast® bases.

Supply Specifications (controller side)

The following table provides supply specifications on the Telefast® bases at controller side:

Supply voltage	Conforming to IEC 61131-2	**V DC**	19…30 (Un = 24)
Maximum supply current per sub-base		**A**	2
Voltage drop on supply fuse		**V DC**	0.3
Supply overload and short-circuit protection by quick-blow fuse (included)		**A**	2

Control Circuit Specifications (sensor/ controller side)

The following table provides specifications on the Telefast® bases control circuit (per channel) at sensor/controller side:

Sub-base type			**Passive connection sub-bases for discrete signals**			**Connection sub-bases with soldered relays**	
	ABE 7	**Unit**	**B20MPN2•**	**E16EPN20**	**E16SPN2•**	**B20MRM20**	**E16SRM20**
Number of channels	Passive input		12	16	–	12	–
	Passive output		8	–	16	–	–
	Solid state output		–	–	–	2	–
	Relay output		–	–	–	6	16
Rated voltage Ue		**V DC**	24				
Min/max voltage	Conforming to IEC 61131-2	**V DC**	20.4/26.4		20.4/28.8	19/30	
Internal current per channel at Ue	Passive input	**mA**	– (3.2 for ABE 7 B20MPN22)	–			
	Passive output	**mA**	– (3.2 for ABE 7 B20MPN22)	–	– (3.2 for ABE 7 E16SPN22)	–	
	Solid state output	**mA**	–			4.5	–
	Relay output	**mA**	–			9	
State 1 guaranteed	Solid state output	**V/mA**	–			16/5.5	–
	Relay output	**V**	–			16.8	
State 0 guaranteed	Solid state output	**V/mA**	–			10/0.4	–
	Relay output	**V**	–			2	
Conformity	Conforming to IEC 61131-2		Type 1	Type 1	–	Type 1	–

Output Circuit Specifications (preactuator side)

The following table provides specifications on the Telefast® bases output circuit (per channel) at preactuator side:

Sub-base type				Passive connection sub-bases for discrete signals			Connection sub-bases with soldered relays	
		ABE 7	Unit	B20MPN2•	E16EPN20	E16SPN2•	B20MRM20	E16SRM20
Number of channels		Passive output		8	–	16	–	–
		Solid state output		–	–	–	2	–
		Relay output		–	–	–	6	16
Contact arrangement				–			1 N/O relay	
Rated voltage at Ue		Passive output	**V DC**	24			–	
		Solid state output	**V DC**	–			24	–
		Relay output	**V DC**	–			5…30	
			V AC	–			110…250	
Current switched per I/O channel		Passive input/output	**mA**	15/300	15/–	–/100	15/–	–
		Solid state output	**A**	–			2	–
		Relay output	**A**	–			3	
Maximum current per common		Passive output	**A**	2	–	1.6	–	
		Solid state output	**A**	–			4	–
		Relay output	**A**	–			10	5
Rated operational current (60 °C max) (for 500 000 operations)		DC 12	**A**	–			2/3	–/3
		DC 13	**A**	–			2/0.5	–/0.5
		AC 12, relay	**A**	–			2	
		AC 15, relay	**A**	–			0.4	
Minimum current			**mA**	–			1/100	–/100
Rated insulation voltage			**V**	Not isolated			300	
Maximum response time	From state 0 to state 1	Solid state output	**ms**	–			0.01	–
		Relay output	**ms**	–			5	5
	From state 1 to state 0	Solid state output	**ms**	–			0.4	–
		Relay output	**ms**	–			2.5	2.5
Channel fuse protection			**mA**	– (315 for ABE 7 B20MPN22)	–	– (125 for ABE 7 E16SPN22)	–	

Telefast® Bases Wiring Schematics

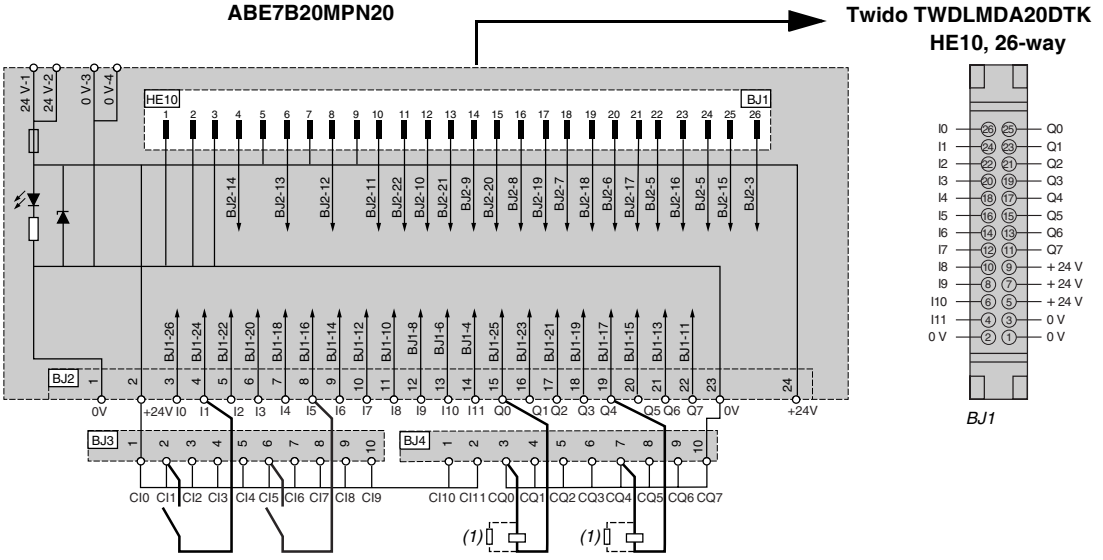
Introduction

This section provides wiring schematics for the Telefast® bases.

> **⚠ WARNING**
>
> **INTERNAL FUSE MAY NOT DEACTIVATE OUTPUTS**
>
> When multiple ABE7 modules are connected to a single PLC output source, module outputs may remain active after an internal fuse is removed or blown. To deactivate module outputs or to service the equipement, halt the PLC, disconnect all power and disconnect the HE10.
>
> **Failure to follow this instruction can result in death, serious injury, or equipment damage.**

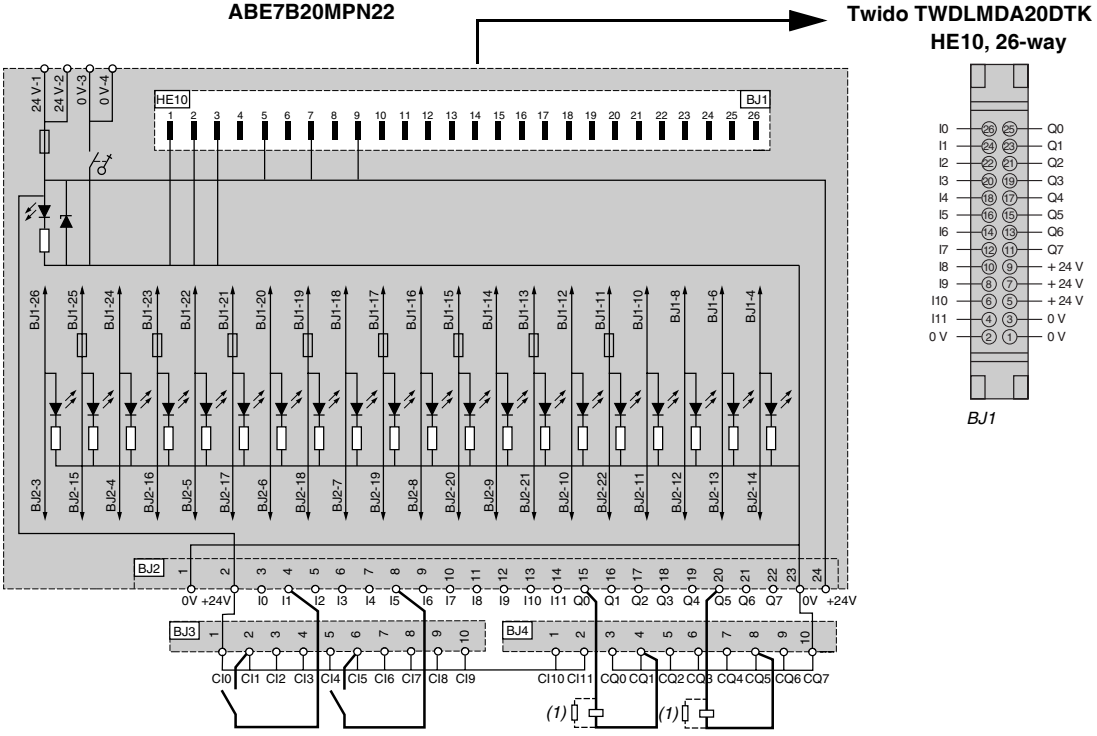
ABE7B20MPN20

The following diagram provides specifications for the ABE7B20MPN20 Telefast® base wiring.



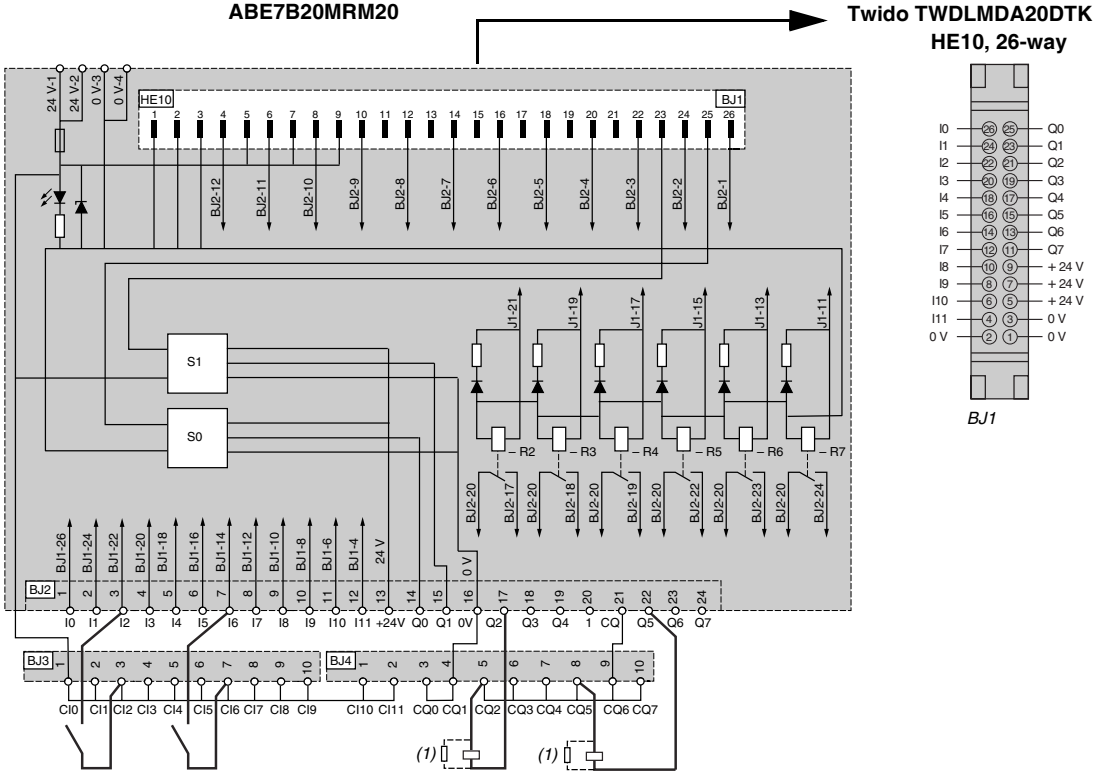
(1) Example of output connections.
When connecting an inductive load, include a diode or a varistor.

ABE7B20MPN22 The following diagram provides specifications for the ABE7B20MPN22 Telefast® base wiring.



(1) Example of output connections.
When connecting an inductive load, include a diode or a varistor.

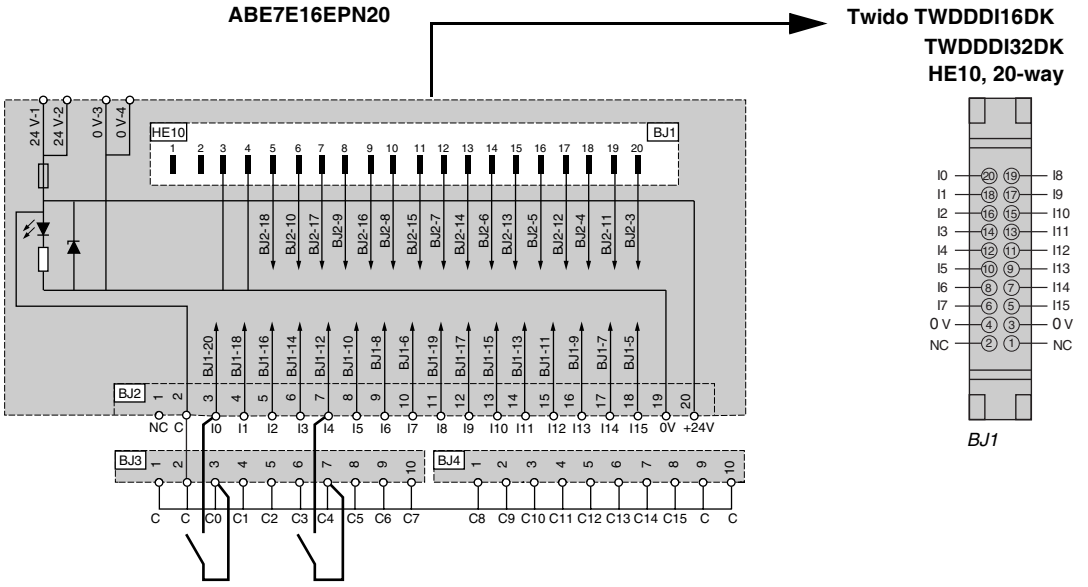
ABE7B20MRM20 The following diagram provides specifications for the ABE7B20MRM20 Telefast® base wiring.



(1) Example of output connections.
When connecting an inductive load, include a diode or a varistor.

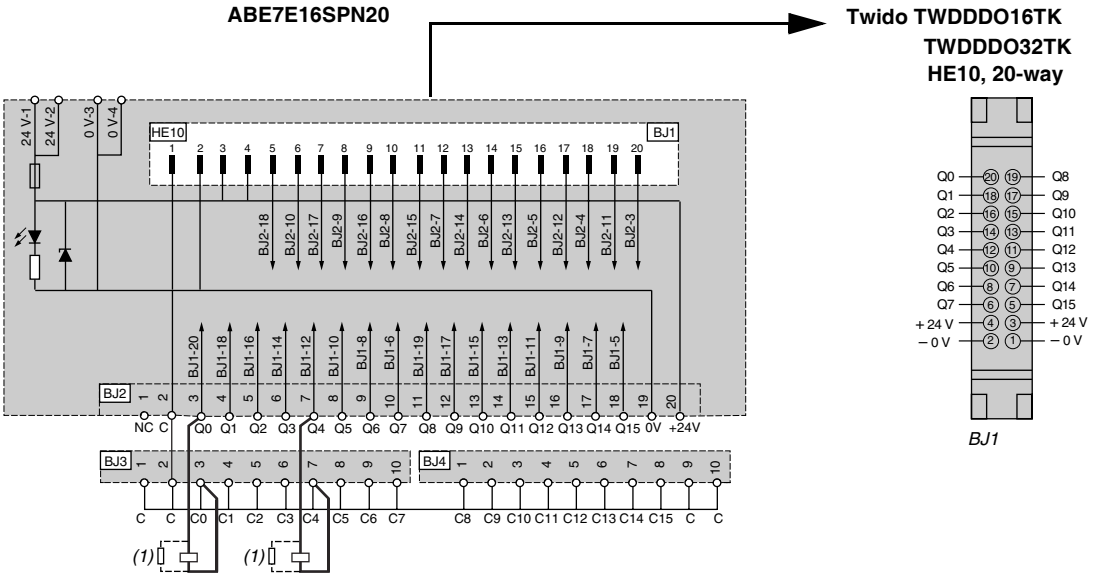
ABE7E16EPN20

The following diagram provides specifications for the ABE7E16EPN20 Telefast® base wiring.



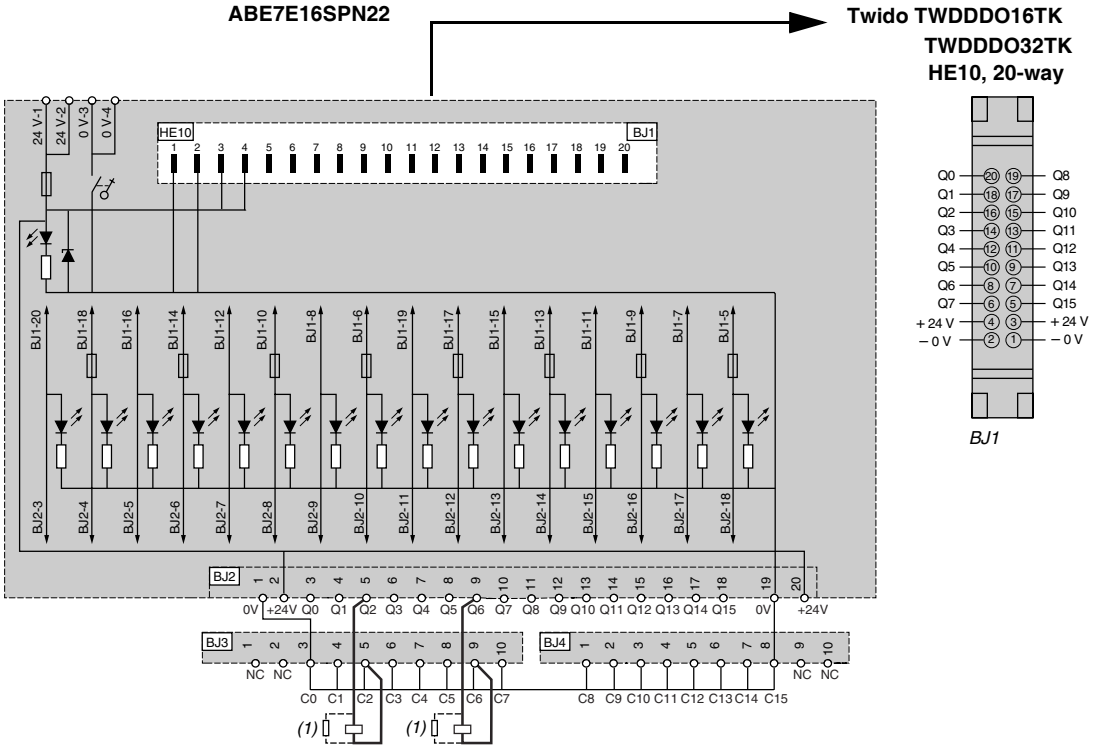
(1) Example of output connections.
When connecting an inductive load, include a diode or a varistor.

ABE7E16SPN20 The following diagram provides specifications for the ABE7E16SPN20 Telefast® base wiring.



(1) Example of output connections.
When connecting an inductive load, include a diode or a varistor.

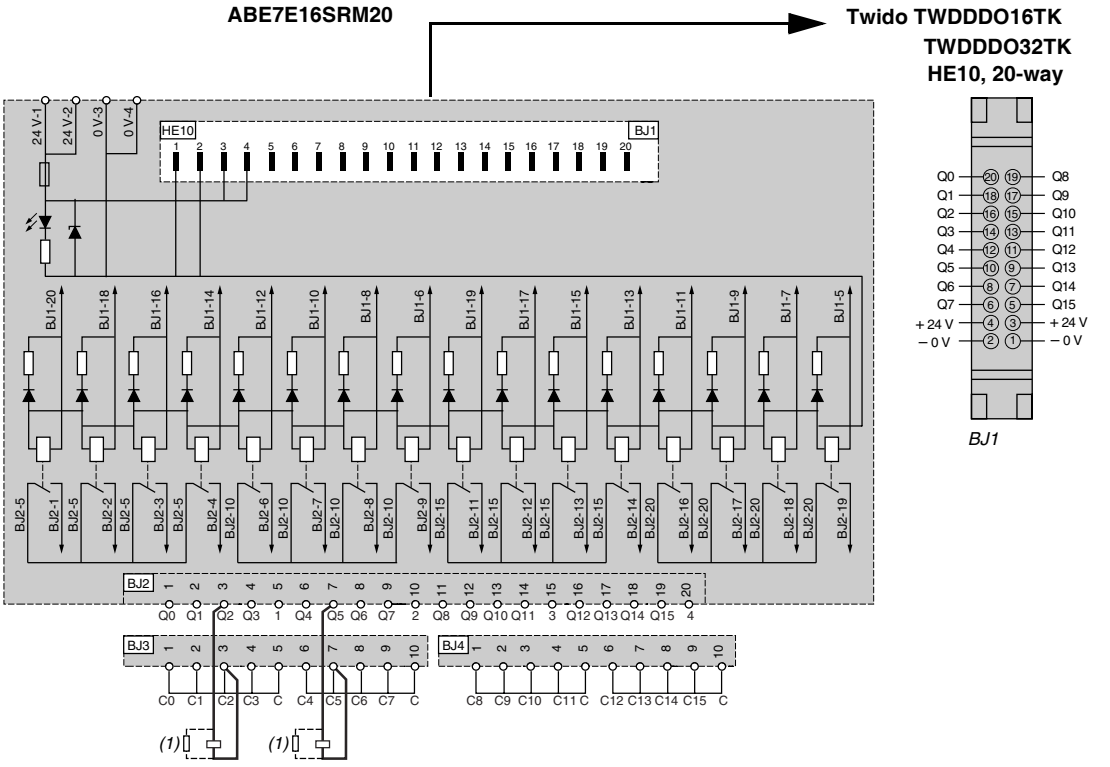
ABE7E16SPN22 The following diagram provides specifications for the ABE7E16SPN22 Telefast® base wiring.



(1) Example of output connections.
When connecting an inductive load, include a diode or a varistor.

ABE7E16SRM20

The following diagram provides specifications for the ABE7E16SRM20 Telefast® base wiring.



(1) Example of output connections.
When connecting an inductive load, include a diode or a varistor.

Installation

3

At a Glance

Introduction

This chapter provides dimensions, installation, and mounting instructions for the controllers, digital and analog expansion I/O modules, and options.

What's in this Chapter?

This chapter contains the following topics:

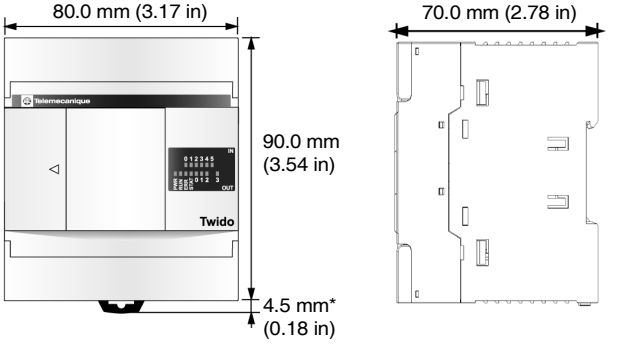
Dimensions of the Compact Controllers

Introduction

The following section shows the dimensions for all Compact controllers.

TWDLC•A10-DRF and TWDLC•A16-DRF

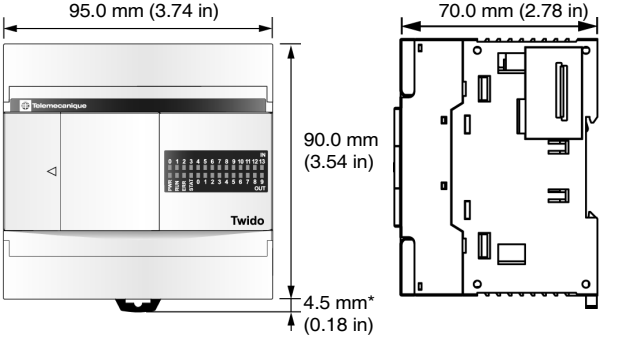
The following diagrams show the dimensions for the TWDLC•A10DRF and TWDLC•A16DRF series Compact controllers.
Illustration showing TWDLC•A10DRF series controller:



Note: * 8.5 mm (0.33 in) when the clamp is pulled out.

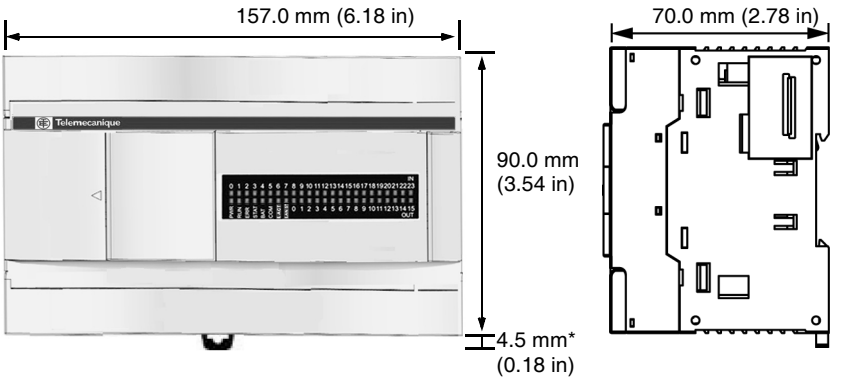
TWDLC•A24-DRF

The following diagrams show the dimensions for the TWDLC•A24DRF series Compact controller.



Note: * 8.5 mm (0.33 in) when the clamp is pulled out.

TWDLCA•40-DRF The following diagrams show the dimensions for the TWDLCA•40DRF series Compact controller.



Note: * 8.5 mm (0.33 in) when the clamp is pulled out.

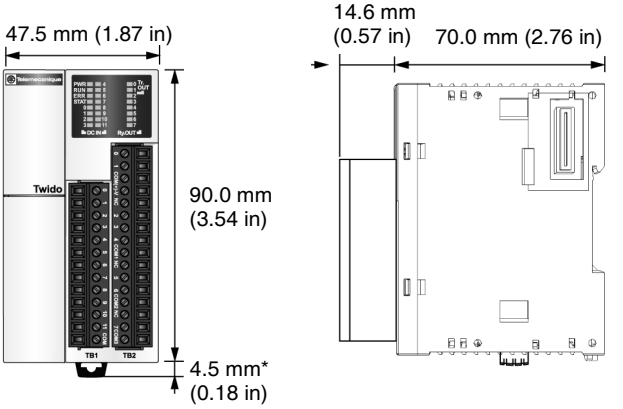
Dimensions for the Modular Controllers

Introduction

The following section shows the dimensions for all Modular controllers.

TWDLMDA20-DRT Dimensions

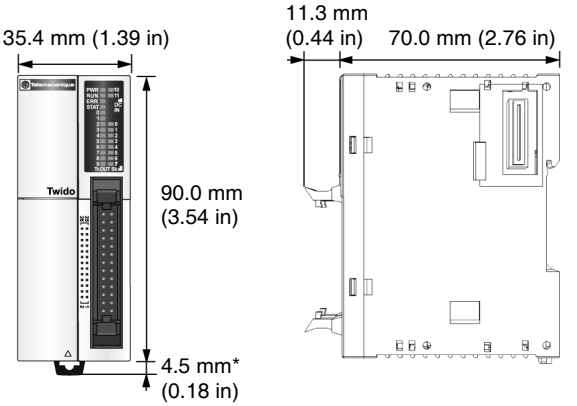
The following diagrams show the dimensions for the TWDLMDA20DRT Modular controller.



Note: * 8.5 mm (0.33 in) when the clamp is pulled out.

TWDLMDA20-DUK and TWDLMDA20-DTK Dimensions

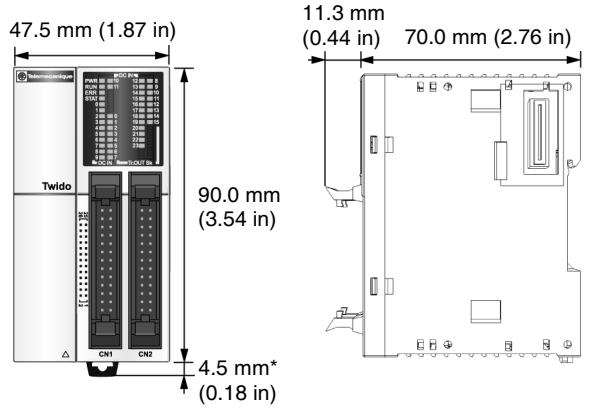
The following diagrams show the dimensions for the TWDLMDA20DUK and TWDLMDA20DTK Modular controllers.



Note: * 8.5 mm (0.33 in) when the clamp is pulled out.

TWDLMDA40-DUK and TWDLMDA40-DTK Dimensions

The following diagrams show the dimensions for the TWDLMDA40DUK and TWDLMDA40DTK Modular controllers.



Note: * 8.5 mm (0.33 in) when the clamp is pulled out.

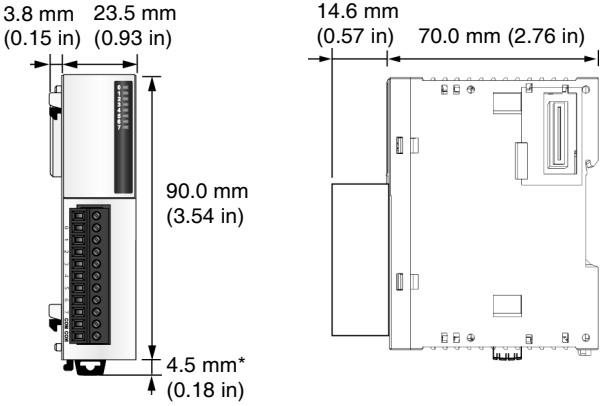
Dimensions for the Digital and Analog I/O Modules

Introduction

The following section shows the dimensions for all digital and analog I/O modules.

Digital I/O Modules (8 In and/or Out) and Analog Modules

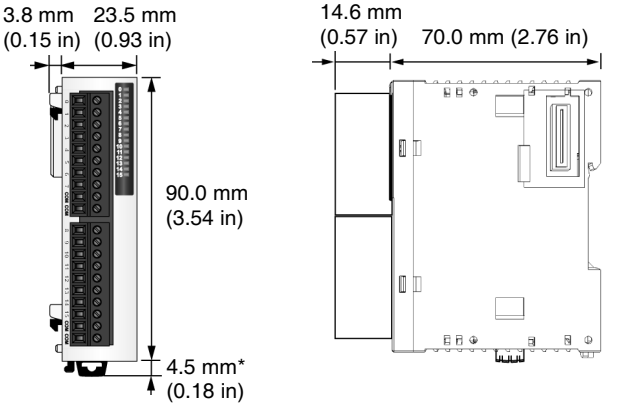
The following diagrams show the dimensions for the 8 inputs and/or outputs digital modules: TWDDDI8DT, TWDDAI8DT, TWDDRA8RT, TWDDDO8TT, TWDDDO8UT, TWDDMM8DRT and for all the analog I/O modules. Illustrations showing a TWDDDI8DT or a TWDDAI8DT module:



Note: * 8.5 mm (0.33 in) when the clamp is pulled out.

Digital I/O Modules (16 In or Out with a Terminal Block)

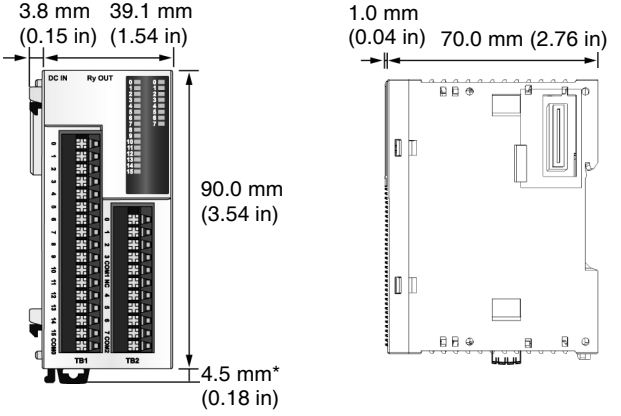
The following diagrams show the dimensions for the TWDDDI16DT and TWDDRA16RT digital I/O modules.
Illustrations showing a TWDDDI16DT module:



Note: * 8.5 mm (0.33 in) when the clamp is pulled out.

Digital I/O Module (16 In and 8 Out)

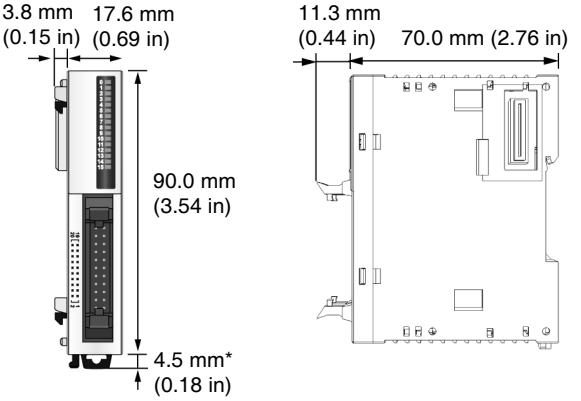
The following diagrams show the dimensions for the TWDDMM24DRF digital I/O module.



Note: * 8.5 mm (0.33 in) when the clamp is pulled out.

Digital I/O Modules (16 In or Out with a Connector)

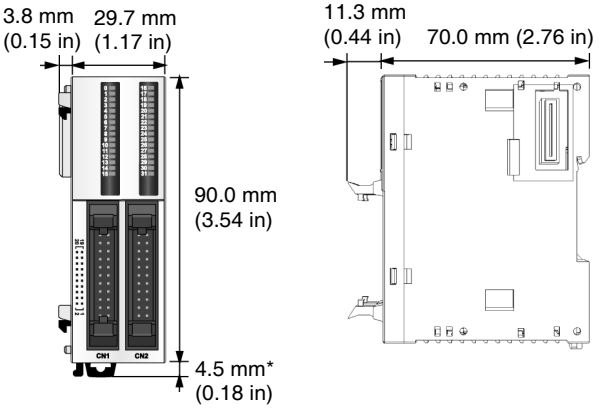
The following diagrams show the dimensions for the TWDDDI16DK, TWDDDO16TK, and TWDDDO16UK digital I/O modules.
Illustrations showing a TWDDDI16DK module:



Note: * 8.5 mm (0.33 in) when the clamp is pulled out.

Digital I/O Modules (32 In or Out)

The following diagrams show the dimensions for the TWDDDI32DK, TWDDDO32TK, and TWDDDO32UK digital I/O modules.
Illustrations showing a TWDDDI32DK module:

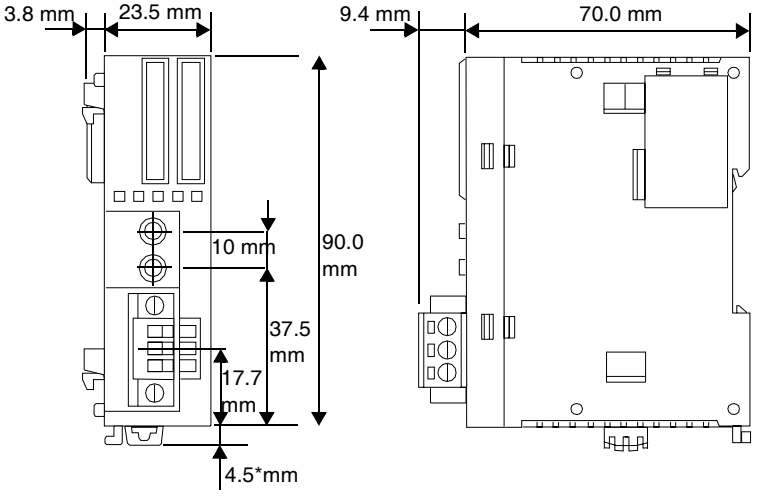


Note: * 8.5 mm (0.33 in) when the clamp is pulled out.

Dimensions of AS-Interface V2 bus master module: TWDNOI10M3

AS-Interface Master Module Dimensions

The following diagram shows the dimensions of the AS-Interface Master module TWDNOI10M3:



Note: * 8.5 mm (0.33 in) when the clamp is pulled out.

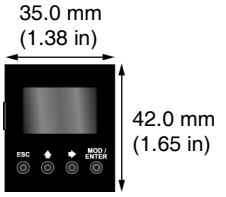
Dimensions for the Operator Display Module, Operator Display Expansion Module, and Communication Expansion Modules

Introduction

The following section shows the dimensions for the operator display module (TWDXCPODC), operator display expansion module (TWDXCPODM), and for all communication expansion modules (TWDNOZ232D, TWDNOZ485T, and TWDNOZ485D).

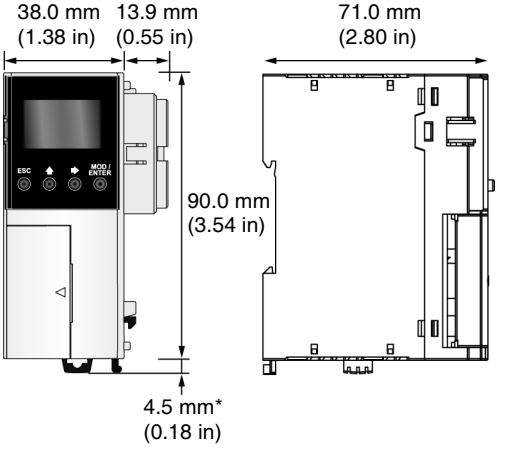
Operator Display Module Dimensions

The following diagram shows the dimensions for the operator display module (TWDXCPODC).



Operator Display Expansion Module Dimensions

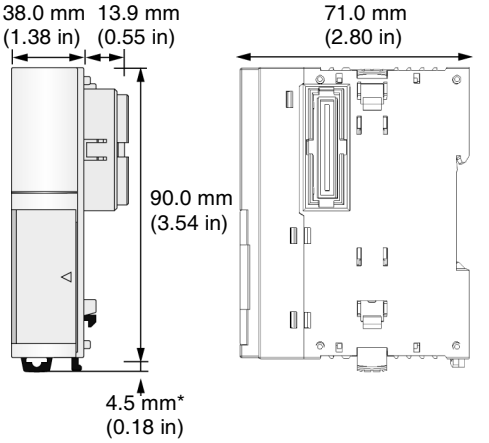
The following diagram shows the dimensions for the operator display expansion module (TWDXCPODM).



Note: * 8.5 mm (0.33 in) when the clamp is pulled out.

Communication Expansion Module Dimensions

The following diagram shows the dimensions for all communication expansion modules (TWDNOZ232D, TWDNOZ485T, and TWDNOZ485D).
Illustration of the TWDNOZ485T module:



Note: * 8.5 mm (0.33 in) when the clamp is pulled out.

Dimensions of the Telefast® Bases

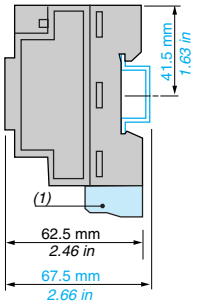
Introduction

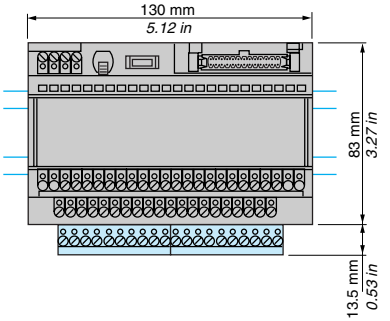
The following section shows the dimensions for the Telefast® bases.

ABE7B20MPN20 ABE7B20MPN22 ABE7B20MRM20 ABE7E16SPN22 ABE7E16SRM20

The following diagrams show the dimensions for the ABE7B20MPN20, ABE7B20MPN22, ABE7B20MRM20, ABE7E16SPN22 and ABE7E16SRM20 Telefast® bases.

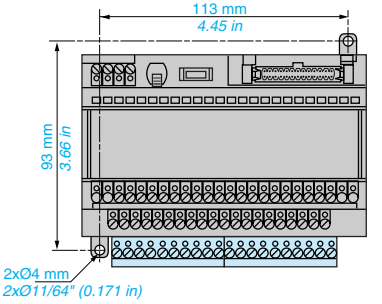
Mounting on 35 mm ⊓ rail





(1) ABE 7BV20, ABE 7BV20TB

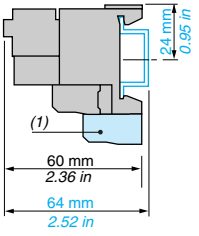
Screw fixing (retractable lugs)

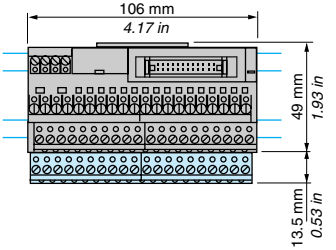


ABE7E16EPN20 ABE7E16SPN20

The following diagrams show the dimensions the dimensions for the ABE7E16EPN20 and ABE7E16SPN20 Telefast® bases.

Mounting on 35 mm ⊓ rail





(1) ABE 7BV20, ABE 7BV20TB

Installation Preparation

Introduction

The following section provides information on preparation for all Twido controllers, expansion I/O modules, AS-Interface bus and CANopen fieldbus interface modules.

Before Starting

Before installing any of the Twido products read the Safety Information at the begging of this book.

> ⚠ CAUTION
>
> **EQUIPMENT DAMAGE**
>
> Before adding/removing any module or adapter, turn off the power to the controller. Otherwise, the module, adapter, or controller may be damaged, or the controller may not operate correctly.
>
> **Failure to follow this instruction can result in injury or equipment damage.**

Note: All options, expansion I/O, AS-Interface bus and CANopen fieldbus interface modules should be assembled before installing a Twido system on a DIN rail, onto a mounting plate, or in a control panel. The Twido system should be removed from a DIN rail, a mounting plate, or a control panel before disassembling the modules.

Controller, Expansion I/O Module, AS-Interface Bus Master Module and CANopen Fieldbus Master Module Mounting Positions

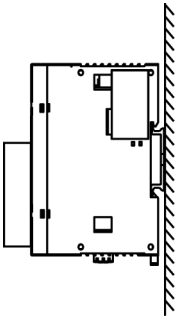
Introduction

This section shows the correct and incorrect mounting positions for all controllers, expansion I/O modules, AS-Interface bus master modules and CANopen fieldbus master module.

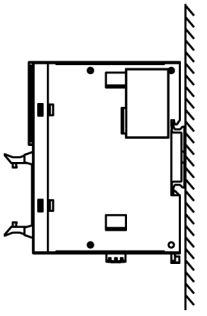
Note: Keep adequate spacing for proper ventilation and to maintain an ambient temperature between 0°C (32°F) and 55°C (131°F).

Correct Mounting Position for all Controllers, Expansion I/O Modules, AS-Interface Bus Master Modules and CANopen Fieldbus Master Module

Controllers, expansion I/O modules, AS-Interface bus and CANopen fieldbus interface modules must be mounted horizontally on a vertical plane as shown in the figures below.



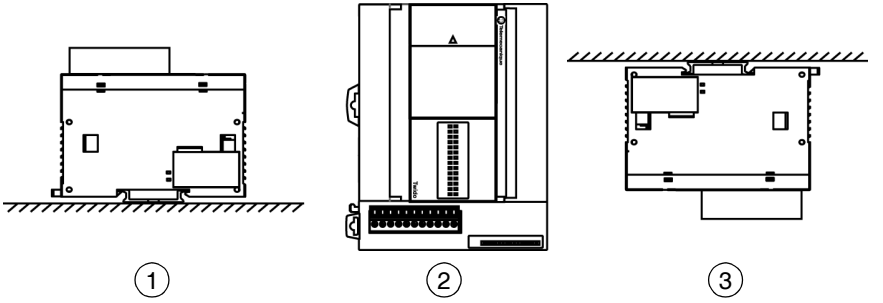
Compact controller with an expansion I/O module



Modular controller with an expansion I/O module

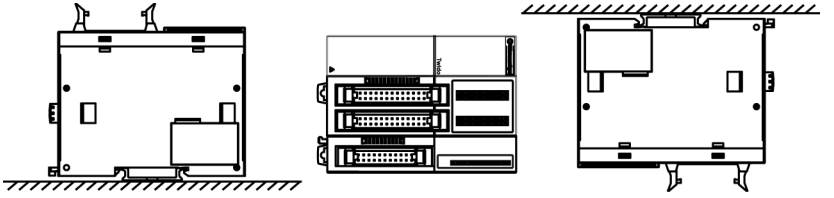
Correct and Incorrect Mounting Positions for the Compact Controller

A Compact controller should only be positioned as shown in "Correct Mounting Position for all Controllers, Expansion I/O Modules, AS-Interface Bus Master Modules and CANopen Fieldbus Master Module" figure. When the ambient temperature is 35°C (95°F) or below, the Compact controller can also be mounted upright on a horizontal plane as shown in (1). When the ambient temperature is 40°C (113°F) or below, the Compact controller can also be mounted sideways on a vertical place as shown in figure (2). Figure (3) shows an incorrect mounting position.



Incorrect Mounting Positions for the Modular Controllers

A Modular controller should only be positioned as shown in "Correct Mounting Position for all Controllers, Expansion I/O Modules, AS-Interface Bus Master Modules and CANopen Fieldbus Master Module" figure. The figures below show the incorrect mounting positions for all Modular controllers.



⚠ CAUTION

PLACING HEAT GENERATING DEVICES NEAR THE CONTROLLER SYSTEM

Do not place heat generating devices such as transformers and power supplies underneath the controllers or expansion I/O modules.

Failure to follow this instruction can result in injury or equipment damage.

Assembling an expansion I/O, an AS-Interface bus master module or a CANopen fieldbus master module to a controller

Introduction

This section shows how to assemble an expansion I/O, an AS-Interface bus master module or a CANopen fieldbus master module to a controller. This procedure is for both Compact and Modular controllers. Your controller, expansion I/O module, or AS-Interface bus master module may differ from the illustrations in this procedure.

⚠ CAUTION

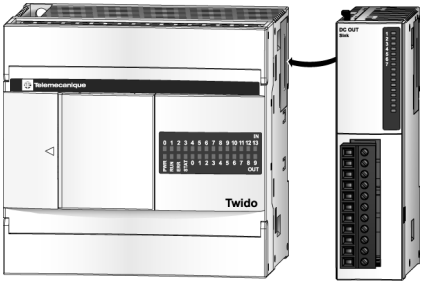
UNEXPECTED EQUIPMENT OPERATION

- If you change the hardware configuration of the I/O expansion bus, AS-Interface bus master module or CANopen fieldbus master module and do not update the software to reflect that change, the expansion bus will no longer operate.
- Be advised that the local base inputs and outputs will continue to operate.

Failure to follow this instruction can result in injury or equipment damage.

Assembling an Expansion I/O, an AS-Interface Bus Master Module or a CANopen Fieldbus Master Module to a Controller.

The following procedure shows how to assemble a controller and an expansion I/O, an AS-Interface bus master module or a CANopen fieldbus master module together.

Step	Action
1	Remove the expansion connector cover from the controller.
2	Make sure the black latch button on the I/O, AS-Interface or CANopen module is in the up position. 
3	Align the connector on the left side of the Expansion I/O module, the AS-Interface master module or the CANopen fieldbus master module with the connector on the right side of the controller. 
4	Press the expansion I/O, the AS-Interface bus master module or the CANopen fieldbus master module to the controller until it "clicks" into place.
5	Push down the black latch button on the top of the expansion I/O, the AS-Interface bus master module or the CANopen fieldbus master moduleto lock the module to the controller.

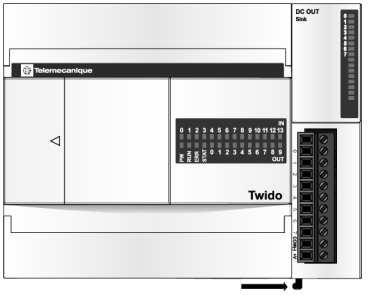
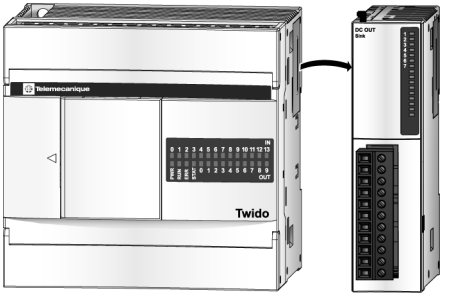
Disassembling an Expansion I/O, an AS-Interface Bus Master Module or a CANopen Fieldbus Master Module from a Controller.

Introduction

This section shows how to disassemble an expansion I/O, an AS-Interface bus master module or a CANopen fieldbus master module from a controller. This procedure is for both Compact and Modular controllers. Your controller, expansion I/O module, AS-Interface bus master module or CANopen fieldbus master module may differ from the illustrations in these procedures but the basic mechanism procedures are still applicable.

Disassembling an Expansion I/O, an AS-Interface Bus Master Module or a CANopen Fieldbus Master Module from a Controller.

The following procedure shows how to disassemble an expansion I/O, an AS-Interface bus master module or a CANopen fieldbus master module from a controller.

Step	Action
1	Remove the assembled controller and module from the DIN rail before disassembling them. See *How to Install and Remove a Controller, an Expansion I/O Module, an AS-Interface Bus Interface Module or a CANopen Fieldbus Master Module from a DIN Rail, p. 227*.
2	Push up the black latch from the bottom of the expansion I/O module, the AS-Interface bus master module or the CANopen fieldbus master module to disengage it from the controller. 
3	Pull apart the controller and module. 

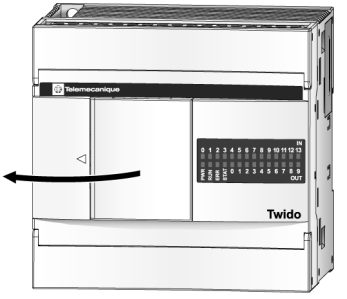
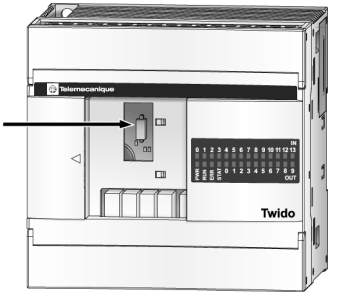
How to Install the Operator Display Module and Operator Display Expansion Module

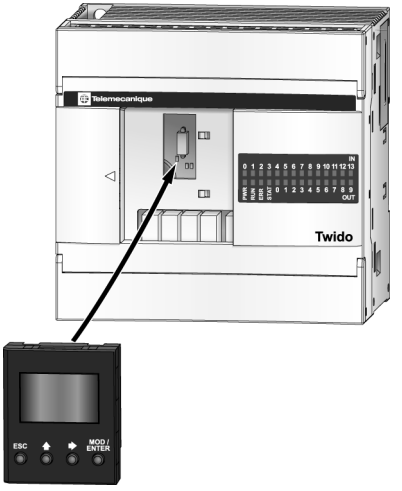
Introduction

This section describes installation of the operator display module TWDXCPODC, as well as installation and removal of the operator display expansion module TWDXCPODM.

Installing the Operator Display Module into a Compact Controller

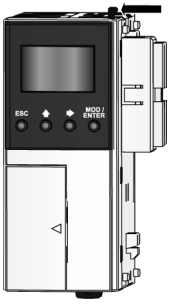
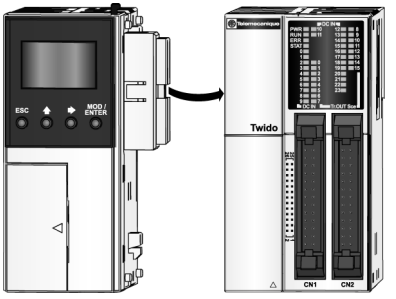
The following procedure shows how to install the TWDXCPODC operator display module into a Compact controller.

Step	Action
1	Remove the operator display connector cover on the Compact controller. 
2	Locate the operator display connector inside the Compact controller. 

Step	Action
3	Push the operator display module into the operator display connector in the Compact controller until it "clicks". 

Assembling the Operator Display Expansion Module to a Modular Controller

The following procedure shows how to assemble the TWDXCPODM operator display expansion module to a Modular controller.

Step	Action
1	Remove the communication connector cover on the left side of the Modular controller.
2	Make sure the black latch button on the operator display expansion module is in the up position. 
3	Align the connector opening on the left side of the Modular controller to the connector on the right side of the operator display expansion module. 
4	Press the operator display expansion module to the Modular controller until it "clicks" into place.
5	Push down the black latch button on the top of the operator display expansion module to lock the module to the Modular controller.

Disassembling an Operator Display Expansion Module from a Modular Controller

To remove the TWDXCPODM operator display expansion module from a Modular controller, see *Disassembling an Expansion I/O, an AS-Interface Bus Master Module or a CANopen Fieldbus Master Module from a Controller., p. 211*.

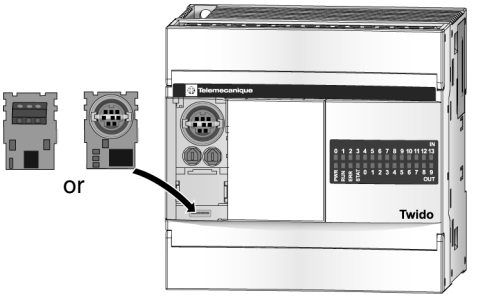
Installing a Communication Adapter and an Expansion Module

Introduction

This section shows how to install the TWDNAC232D, TWDNAC485D, or TWDNAC485T communication adapter into a Compact controller's port 2 and in a TWDXCPODM operator display expansion module. This section also shows how to assemble and disassemble the TWDNOZ232D, TWDNOZ485D, and TWDNOZ485T communication expansion module to a Modular controller. Your controller may differ from the illustrations in these procedures but the basic mechanism procedures are applicable.

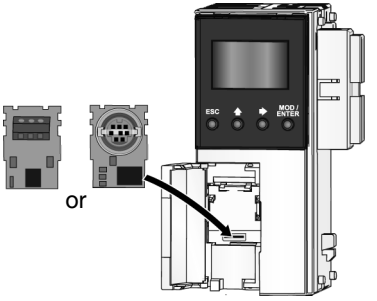
Installing the Communication Adapter into a Compact Controller's Port 2

The following procedure shows how to install the TWDNAC232D, TWDNAC485D, or TWDNAC485T communication adapter into a Compact controller's port 2.

Step	Action
1	Open the hinged lid.
2	Remove the cartridge cover located on the bottom of the Compact controller.
3	Push the communication adapter's connector into the Compact controller's port 2 connector until it "clicks". 
4	Look in the opening at the bottom of the Compact controller where the cartridge cover resided and make sure the communication adapter's connector is seated in the Compact controller's port 2 connector. Adjust the adapter if it is not seated correctly.
5	Attach the cartridge cover.

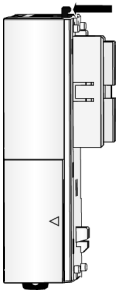
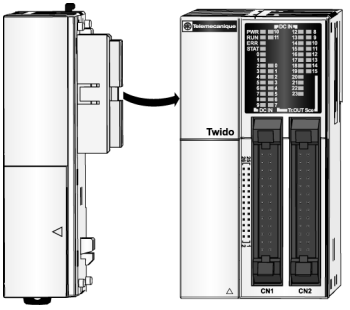
Installing a Communication Adapter in the Operator Display Expansion Module

The following procedure shows how to install the TWDNAC232D, TWDNAC485D, or TWDNAC485T communication adapter in a TWDXCPODM operator display expansion module.

Step	Action
1	Open the hinged lid.
2	Push the communication adapter's connector into the operator display expansion module's connector until it "clicks". 
3	Close the hinged lid.

Assembling a Communication Expansion Module to a Modular Controller

The following procedure shows how to assemble the TWDNOZ485D, TWDNOZ232D, or TWDNOZ485T communication expansion module to a Modular controller.

Step	Action
1	Remove the communication connector cover on the left side of the Modular controller.
2	Make sure the black latch button on the communication expansion module is in the up position. 
3	Align the connector opening on the left side of the Modular controller to the connector on the right side of the communication expansion module. 
4	Press the communication expansion module to the Modular controller until it "clicks" into place.
5	Push down the black latch button on the top of the communication expansion module to lock the module to the Modular controller.

Disassembling a Communication Expansion Module from a Modular Controller

To disassemble a communication expansion module from a Modular controller, see *Disassembling an Expansion I/O, an AS-Interface Bus Master Module or a CANopen Fieldbus Master Module from a Controller., p. 211*.

How to Install the TwidoPort Ethernet Interface Module

Introduction

This section shows how to install the TwidoPort Ethernet interface module and connect it to a Twido controller.

Foreword

The equipment is delivered in ready-to-operate condition. The following procedure is appropriate for installation.

Proper Grounding

⚠ WARNING

RISK OF ELECTRIC SHOCK

The grounding screw terminal (PE) must be used to provide protective earth at all times. Make sure that PE is attached before connecting or disconnecting any Ethernet shielded cables to the device.

Failure to follow this instruction can result in death, serious injury, or equipment damage.

Ground Cable

The PE ground must be capable of supporting 30 A of current for 2 minutes and have no more than 50 mΩ of resistance. The recommended PE wire size is AWG #12 (3.2 mm^2) through #18 (0.87 mm^2). The maximum allowable length of the wire at AWG # 8 is less than 2 meters (6.56 ft).

The TwidoPort-to-Twido Controller Connecting Cable

The supplied TwidoPort-to-Twido cable is 50 cm (1.64 ft) long. It has a mini-din connector at one end and a modular plug at the other:

Mounting Instructions

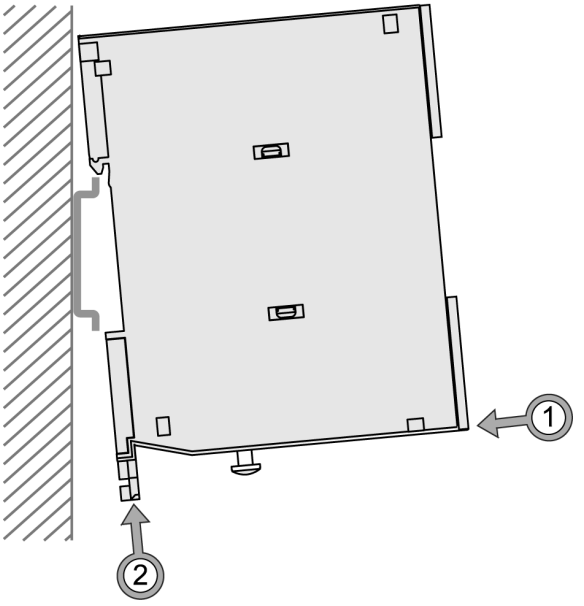
Usually, TwidoPort is mounted on a DIN rail or a panel with the Twido panel mount kit (TWDXMT5).

Note: Before installing a TwidoPort module, read the Safety Information at the beginning of this guide as well as the instructions for Proper Grounding (See *Proper Grounding, p. 221*) in this section.

To connect TwidoPort to the DIN rail, take the following steps (as shown in the diagram below):

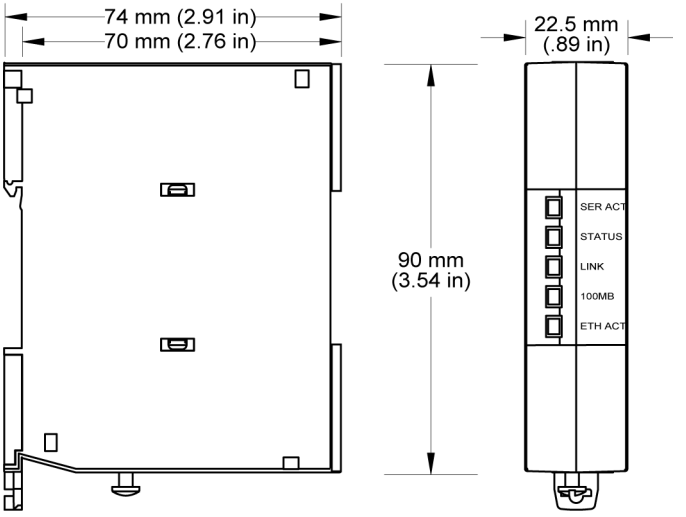
Step	Action	Comment
1	Attach the hinges on the back of TwidoPort to the DIN rail, then press down to align TwidoPort vertically with the rail.	Make sure the DIN rail latch is pulled down to the open position.
2	Lock TwidoPort to the DIN rail.	Push up the plastic DIN rail clip on the bottom.

The following figure shows TwidoPort being mounted on a DIN rail:



TwidoPort Dimensions

The following diagram shows the dimensions of TwidoPort:



How to Install a Memory or RTC Cartridge

Introduction

This section shows how to install the TWDXCPMFK32 memory cartridge in a Compact controller, the TWDXCPMFK32 or TWDXCPMFK64 memory cartridge in a Modular controller, and the TWDXCPRTC RTC cartridge in a Compact controller and Modular controller.

Installing a Cartridge in a Compact Controller

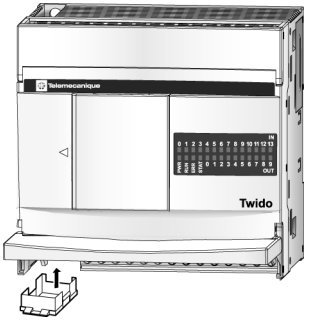
The following procedure shows how to install the TWDXCPMFK32 memory or the TWDXCPRTC RTC cartridge in a Compact controller. Only one of these cartridges can be installed in the Compact controller.

⚠ CAUTION

EQUIPMENT DAMAGE

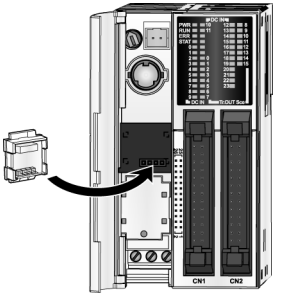
When handling the cartridges, do not touch the pins. The cartridge's electrical elements are sensitive to static electricity. Use proper ESD procedures when handling a cartridge.

Failure to follow this instruction can result in injury or equipment damage.

Step	Action
1	Open bottom terminal cover.
2	Remove the cartridge cover.
3	Push the cartridge into the cartridge connector until it "clicks". 
4	Close the terminal cover.

Installing a Cartridge in a Modular Controller

The following procedure shows how to install the TWDXCPMFK32 or TWDXCPMFK64 memory cartridge or the TWDXCPRTC RTC cartridge in a Modular controller. Only one RTC cartridge can be installed. A memory cartridge and an RTC cartridge can be installed at the same time.

Step	Action
1	Open the hinged door.
2	Remove the cartridge cover by holding and pulling the opposite edges of the cover until it is out.
3	Push the cartridge into the Modular controller's connector until it "clicks". 
4	Close the hinged door.

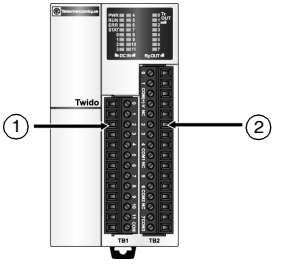
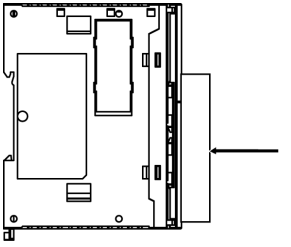
Removing a Terminal Block

Introduction

This section shows how to remove a terminal block from the TWDLMDA20DRT Modular controller.

Removing a Terminal Block

The following procedure shows how to remove a terminal block from the TWDLMDA20DRT Modular controller.

Step	Action
1	Power off to the Modular controller and disconnect all wires. **Note:** The terminal block on the left (1) must be removed before the terminal block on the right (2). 
2	Remove the terminal block by holding the center of the terminal block and pulling it out straight. 

⚠ CAUTION

TERMINAL BLOCK DAMAGE

Do not pull the terminal block out from the top or bottom of the block.

Failure to follow this instruction can result in injury or equipment damage.

How to Install and Remove a Controller, an Expansion I/O Module, an AS-Interface Bus Interface Module or a CANopen Fieldbus Master Module from a DIN Rail

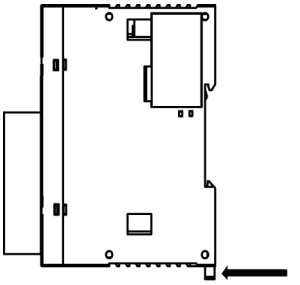
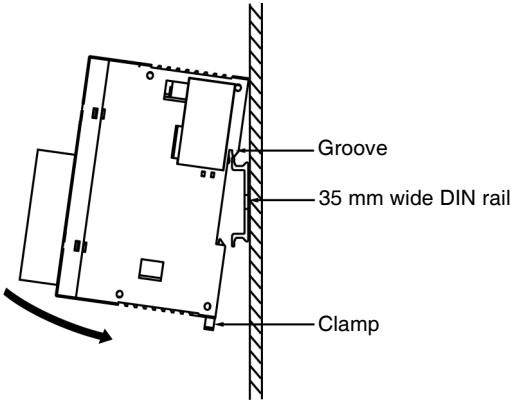
Introduction

This section describes how to install and remove controllers, expansion I/O modules, AS-Interface bus master modules or CANopen fieldbus master module from a DIN rail. The device you want to install or remove may differ from the illustrations in these procedures but the basic mechanism procedures are applicable.

Note: When mounting controllers on a DIN rail, use two end stops, type AB1-AB8P35 or equivalent.

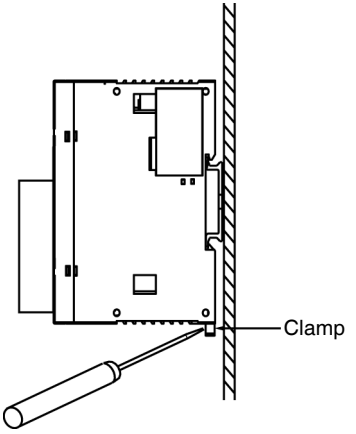
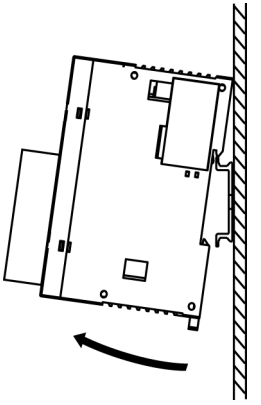
How to Install a Controller, Expansion I/O Module, AS-Interface Bus Interface Module or CANopen Fieldbus Master Module on a DIN Rail

The following procedure shows how to install a controller, expansion I/O module, AS-Interface bus master module or CANopen fieldbus master module on a DIN rail.

Step	Action
1	Fasten the DIN rail to a panel using screws.
2	Pull out the clamp at the bottom of the controller and module assembly. 
3	Put the top groove of the controller and module on the DIN rail and press the modules toward the DIN rail. 
4	Push the clamp into the DIN rail.
5	Place mounting clips on both sides of the modules to prevent the system from moving sideways.

How to Remove a Controller, Expansion I/O Module, AS-Interface Bus Interface Module or CANopen Fieldbus Master Module from a DIN Rail

The following procedure shows how to remove a controller, an expansion I/O module, an AS-Interface bus master module or a CANopen fieldbus master module from a DIN rail.

Step	Action
1	Insert a flat screwdriver into the slot in the clamp. 
2	Pull out the clamp.
3	Pull the controller and the associated module off the DIN rail from the bottom. 

How to Direct Mount on a Panel Surface

Introduction

This section shows how to install mounting strips directly on modular controllers, expansion I/O modules, AS-Interface bus interface modules, the CANopen fieldbus interface module, the operator display expansion module, and communication expansion modules. This section also provides mounting hole layouts for each controller and module. Your controller or module may differ from the illustrations in these procedures but the basic mechanism procedures are applicable.

Installing a Mounting Strip

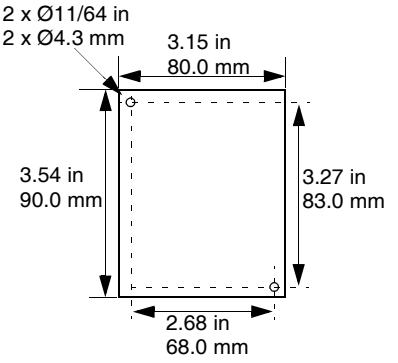
The following procedure shows how to install a mounting strip.

Step	Action
1	Remove the clamp from the back side of the module by pushing the clamp inward.
2	Insert the mounting strip, with the hook entering last, into the slot where the clamp was removed.
3	Slide the mounting strip into the slot until the hook enters into the recess in the module.

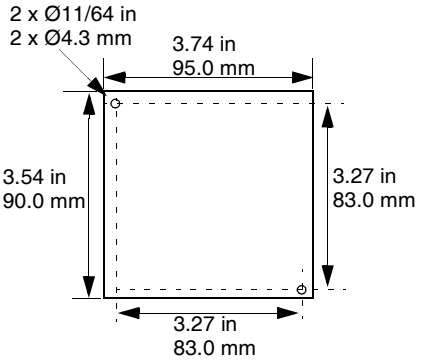
Mounting Hole Layout for Compact Controllers

The following diagram shows the mounting hole layout for all the Compact controllers.

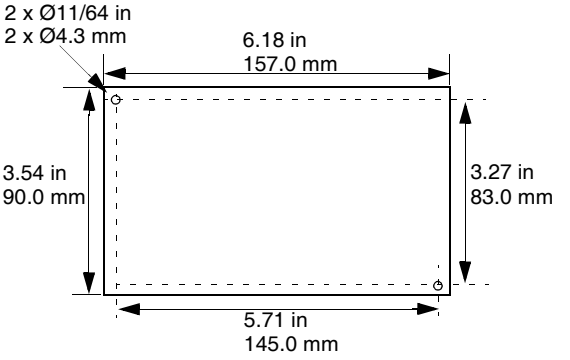
TWDLC•A10DRF
TWDLC•A16DRF



TWDLC•A24DRF



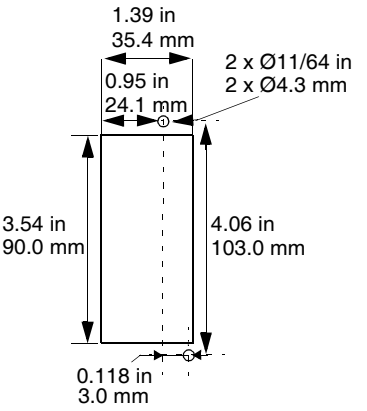
TWDLCA•40DRF



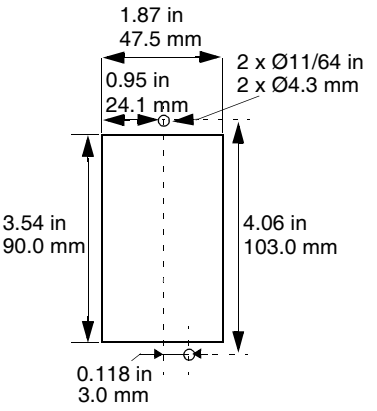
Mounting Hole Layout for Modular Controllers

The following diagram shows the mounting hole layout for all the Modular controllers.

TWDLMDA20DUK
TWDLMDA20DTK



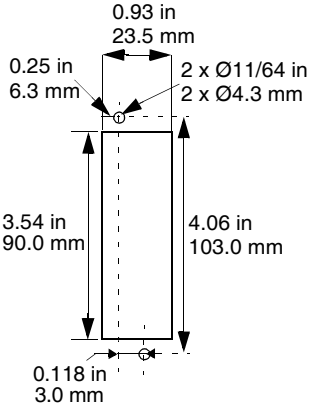
TWDLMDA20DRT
TWDLMDA40DUK
TWDLMDA40DUK



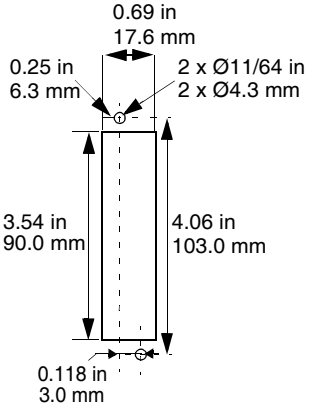
Mounting Hole Layout for Expansion I/O Modules

The following diagram shows the mounting hole layout for the expansion I/O modules.

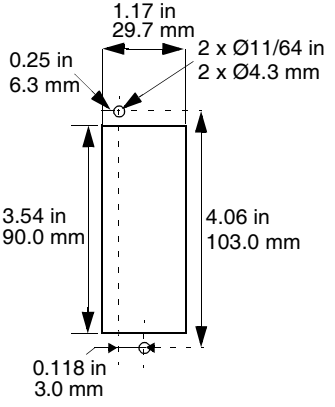
TWDDDI8DT
TWDDAI8DT
TWDDDI16DT
TWDDRA8RT
TWDDRA16RT
TWDDDO8UT
TWDDDO8TT
TWDDMM8DRT
TWDALM3LT
TWDAMM3HT
TWDAMI2HT
TWDAMO1HT
TWDAVO2HT
TWDAMI4LT
TWDAMI8HT
TWDARI8HT



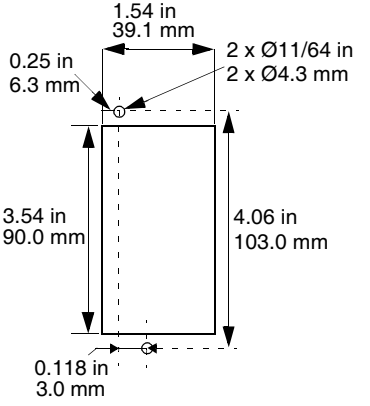
TWDDDI16DK
TWDDDO16TK
TWDDDO16UK



TWDDDI32DK
TWDDDO32TK
TWDDDO32UK

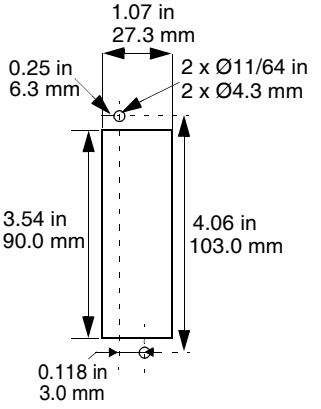


TWDDMM24DRF



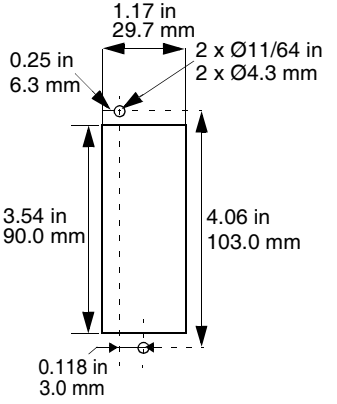
Mounting Hole Layout for the AS-Interface Bus Interface Module

The following diagram shows the mounting hole layout for the TWDNOI10M3 AS-Interface bus interface module:



Mounting Hole Layout for the CANopen Fieldbus Master Module

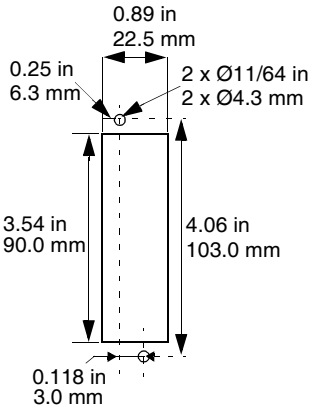
The following diagram shows the mounting hole layout for the TWDNCO1M CANopen fieldbus master module:



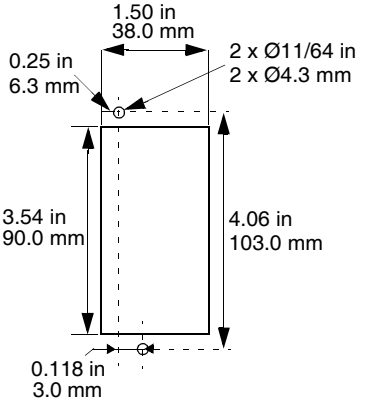
Mounting Hole Layout for Communication Expansion and Operator Display Expansion Modules

The following diagram shows the mounting hole layout for the communication expansion and operator display expansion modules.

TWDNOZ485D
TWDNOZ232D
TWDNOZ485T



TWDXCPODM



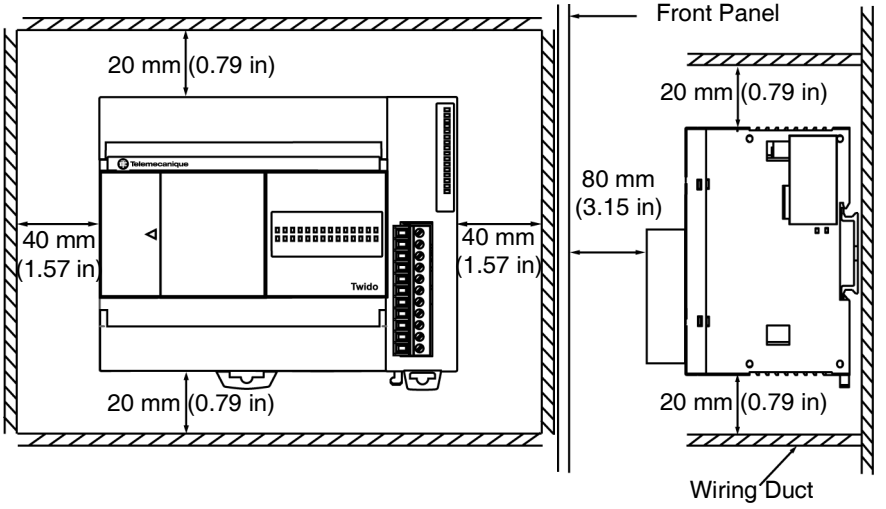
Minimum Clearances for Controllers and Expansion I/O Modules in a Control Panel

Introduction

This section provides the minimum clearances for controllers and expansion I/O modules in a control panel.

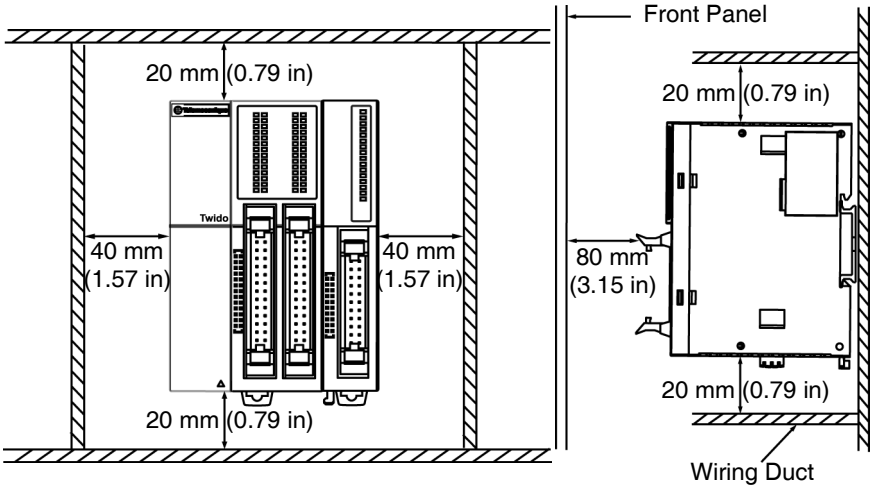
Minimum Clearances for a Compact Controller and Expansion I/O Modules

In order to maintain a natural circulation of air around the Compact controller and expansion I/O modules in a control panel, observe the minimum clearances shown in the figures below.



Minimum Clearances for a Modular Controller and Expansion I/O Modules

In order to maintain a natural circulation of air around the Modular controller and expansion I/O modules in a control panel, observe the minimum clearances shown in the figures below.



How to Connect the Power Supply

Introduction

This section describes how to connect the power supply to the Compact and Modular controllers.

Note: When operating outside of the specified voltage range, outputs may not switch accordingly. Use appropriate safety interlocks and voltage monitoring circuits.

⚠ CAUTION

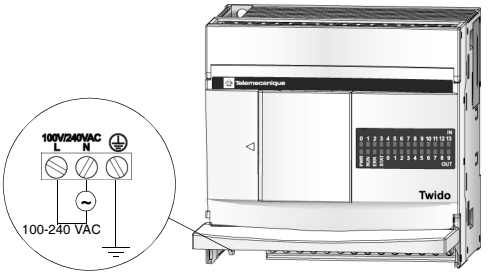
MAKE PROPER POWER SUPPLY CONNECTIONS

- Make sure that proper voltage and frequency is applied to the device.
- Verify that you have made proper lead connections to the power supply terminal block.

Failure to follow this instruction can result in injury or equipment damage.

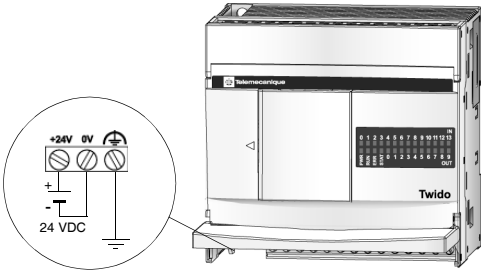
Connect an AC Power Supply to a Compact Controller

The following diagram shows how to connect an AC power supply to a TWDLCA•••DRF series Compact Controller.



Connect a DC Power Supply to a Compact Controller

The following diagram shows how to connect a DC power supply to a TWDLCD••DRF series Compact Controller.



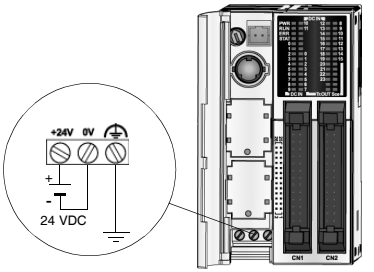
Compact Controller Power Supply Specifications

The following table provides power supply information for the Compact controller.

Item	AC Specifications	DC Specifications
Power supply voltage	Rated power voltage: from 100 to 240 VAC	Rated power voltage: 24 VDC
	Allowable range: from 85 to 264 VAC	Allowable range: from 19.2 to 30 VDC
	The detection of the absence of a power supply depends on the number of inputs and outputs used. Usually the absence of a power supply is detected when voltage drops to less than 85 VAC, stopping the current operation to prevent malfunction.	The detection of the absence of a power supply depends on the number of inputs and outputs used. Usually the absence of a power supply is detected when voltage drops to below 14 VDC, stopping the current operation to prevent malfunction.
	Note: Momentary power interruption for 20 ms or less at 100 to 240 VAC is not recognized as power failure.	**Note:** Momentary power interruption for 10 ms or less at 24 VDC is not recognized as failure.
Inrush current flow at power-up	TWDLCAA10DRF and TWDLCAA16DRF: 35 A maximum TWDLCAA24DRF: 40 A maximum	
Power supply wiring	0.64 mm^2 (UL1015 AWG22) or 1.02 mm^2 (UL1007 AWG18) Make the power supply wiring as short as possible.	
Ground wiring	1.30 mm^2 (UL1007 AWG16) Do not connect ground wire in common with ground wire of motor equipment.	

Connect a Power Supply to a Modular Controller

The following diagram shows how to connect a power supply to a Modular Controller.



Modular Controller Power Supply Specifications

The following table provides power supply information for the Modular controller.

Item	Specifications
Power supply voltage	Rated power voltage: 24 VDC Allowable range: from 20.4 to 26.4 VDC The detection of the absence of a power supply depends on the number of inputs and outputs used. Usually the absence of a power supply is detected when voltage drops to below 20.4 VDC, stopping the current operation to prevent malfunction. **Note:** Momentary power interruption for 10 ms or less at 24 VDC is not recognized as failure.
Inrush current flow at power-up	50 A maximum
Power supply wiring	0.64 mm^2 (UL1015 AWG22) or 1.02 mm^2 (UL1007 AWG18) Make the power supply wiring as short as possible.
Ground wiring	0.64 mm^2 (UL1015 AWG22) or 1.02 mm^2 (UL1007 AWG18) Do not connect ground wire in common with ground wire of motor equipment.

How to Install and Replace an External Battery

Note: The following information about the external battery applies to TWDLCAA40DRF and TWDLCAE40DRF series compact base controllers only.If you own another model of compact or modular controller, you may skip this section.

Introduction

In addition to the built-in internal battery used for RAM backup, each of the TWDLCAA40DRF and TWDLCAE40DRF compact base controllers is equipped with a battery compartment that can host a user-replaceable external battery. Note that for most applications, no external battery is required.
The external battery option provides extended backup duration to meet the needs for long-term backup for specific applications, such as HAVC applications.

Battery Type

Your compact base controller uses one 1/2 AA, 3.6 V, lithium battery to provide optional extended data storage duration of up to 3 years.

Note: The external battery is not included with your Twido controller; you must purchase it separately. Please use part number TSXPLP01 to order a single battery or TSXPLP101 to order a 10 pack.

Battery Power Status

The BAT LED indicator located on the front panel of your Twido compact controller serves as an indicator for low battery warning. The BAT LED state is described in the following table:

LED State	Description
Extinguished	Indicates that either: • the external battery is functioning normally, or • the BAT LED has been disabled by user by setting the %S66 system bit to 1.
Steady red	Indicates that either: • the power of the external battery is low (voltage below 2.5V) (The external battery must be replaced within two weeks from the date the BAT LED was first lit.), or • there is no external battery installed in the battery compartment.

Battery Installation Requirements

When installing or replacing the external battery, make sure the following two conditions are both met:

1. The internal battery of your Twido compact base must be fully charged.
2. After installing the external battery, you must power up your Twido controller immediately.

Note: Failure to meet any of the above two conditions will result in a significantly shorter battery life. The external battery life can be rapidly reduced to less than one month.

Installing and Replacing an External Battery

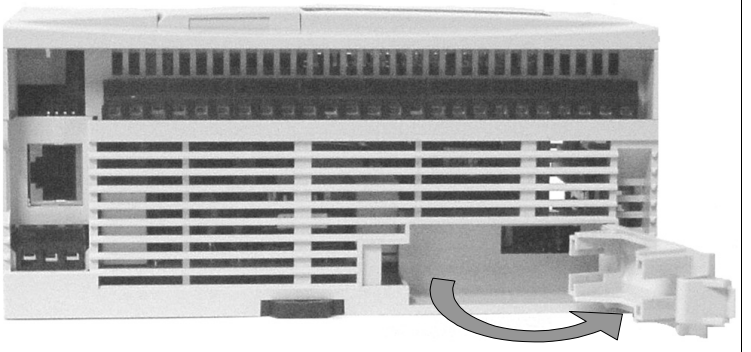
The battery compartment is located on the lower-panel of the Twido compact controller case. To install or replace an external battery, follow these steps:

⚠ WARNING

EXPLOSION AND FIRE HAZARD

- Replace cell with part number TSXPLP01 (Tadiran, TL-5902) only.
- Use of another cell or battery may present a risk of fire or explosion.

Failure to follow this instruction can result in death, serious injury, or equipment damage.

Step	Action
1	Before installing or replacing the external battery, you must first make sure that the internal battery of your Twido controller is fully charged. This precaution is to ensure that the data stored in RAM memory are not lost when the external battery is removed from its compartment.
2	Press sideways on the small latch protruding from the compartment cover to unlock the door of the battery compartment.
3	Pull to open the compartment door, as shown in the figure below: 
4	Remove the used battery from the compartment, if any.
5	Insert the new battery in the compartment, observing the correct polarity, as indicated by the polarity marking located inside the battery compartment.
6	Close the door of the battery compartment (make sure the latch clicks into place to lock the compartment door).
7	Power up your Twido controller immediately to preserve battery life.

Safe Battery Disposal

The TWDLCA•40DRF compact bases use an optional external lithium battery for longer duration of data backup. (Note: The lithium battery is not supplied with the compact bases; you must purchase it separately.)

⚠ WARNING

EXPLOSION AND TOXIC HAZARD

- Do not incinerate a lithium battery for it may explode and release toxic substances.
- Do not handle damaged or leaking lithium battery.
- Dead batteries shall be disposed of properly, for improper disposal of unused batteries can cause harm, as well as environmental damage.
- In some areas, the disposal of lithium batteries with household or business trash collection may be prohibited. In any case, it is your responsibility to always conform to local regulations in your area, as regard to battery disposal.

Failure to follow this instruction can result in death, serious injury, or equipment damage.

Battery Status Monitoring and Control via System Bits

The following information describes how the battery status can be monitored and how the battery LED management can be controlled via two system bits %S75 and %S66, respectively:

System Bit	Description
%S75	This is a read-only system bit that indicates the current battery status: • %S75 = 0: external battery is operating normally. • %S75 = 1: external battery power is low, or battery is absent from compartment.
%S66	This system bit is writable and allows you to turn on/off the BAT LED: • Set this bit to 1 to disable the BAT LED (LED is always off even if there is no battery inside the compartment). • Set this bit to 0 to enable the BAT LED indicator. Note that the %S66 system bit is reset to 0 as default at system start-up.

Special Functions

4

At a Glance

Introduction

This chapter provides an introduction and I/O assignments for the Twido controllers' special functions. For information on configuring and using these special functions see the Twido Software Reference Guide.

What's in this Chapter?

This chapter contains the following topics:

RUN/STOP Input

Introduction

This section provides basic information on the RUN/STOP input special function.

Principle

The RUN/STOP input is a special function that can be assigned to any one of the base controller inputs. This function is used to start or stop a program.

Determining the State of Run/ Stop Input

At power up, if configured, the controller state is set by the Run/Stop input:

- if RUN/STOP input is at state 0, controller is in STOP mode.
- if RUN/STOP input is at state 1, controller is in RUN mode.

While the controller is powered, a rising edge on the RUN/STOP input state sets the controller to RUN. The controller is stopped if the RUN/STOP input is at 0. If the RUN/STOP input is at 0, a RUN command from a connected PC is ignored by the controller.

Controller Status Output

Introduction

This section provides basic information on the controller status output special function.

Principle

The controller status output is a special function that can be assigned to one of three outputs (%Q0.0.1 and %Q0.0.3) on a base or a remote controller.
At power up, if there is no controller error see *Troubleshooting Using the Controller's LEDs, p. 258*, the controller status output changes to 1. This function can be used in safety circuits external to the controller, for example, to control:

- The power supply to the output devices.
- The controller power supply.

Latching input

Introduction

This section provides basic information on the latching inputs special function.

Principle

The latching inputs is a special function that can be assigned to one of four inputs (%I0.0.2 to %I0.0.5) on a base or a remote controller. This function is used to memorize any pulse with a duration less than the controller scan time. When a pulse is shorter than one scan and has a value greater than or equal to 1 ms, the controller latches the pulse, which is then updated in the next scan.

Fast Counting

Introduction

This section provides basic information on the fast counting special function.

Principle

The base controllers have two fast counter types:
- A single up counter with a maximum frequency of 5 kHz.
- A single down counter with a maximum frequency of 5 kHz.

The single up counter and single down counter functions enable up counting or down counting of pulses (rising edges) on a digital I/O. The fast counter functions enable counting of pulses from 0 to 65535 in single-word mode and from 0 to 4294967296 in double-word mode.

Controllers Fast Counting Capabilities

Compact controllers can have up to 3 fast counters, with the exception of the TWDLCA•40DRF series compact controllers that have 4 fast counters. Modular controllers can have up to 2 fast counters. The availability of the double-word counting option depends on the controller model. The following table lists the fast counting capabilities of the Twido line Compact and Modular controllers.

Twido Line Controllers	**Compact controllers TWDLC••...**				**Modular controllers TWDLMDA...**	
	10DRF	**16DRF**	**24DRF**	**40DRF**	**20D••**	**40D••**
Fast Counters	3	3	3	4	2	2
Single-Word	Yes	Yes	Yes	Yes	Yes	Yes
Double-Word	No	Yes	Yes	Yes	Yes	Yes

Digital I/O Assignment for a Fast Counter

The digital I/O assignment for fast counters depends on whether digital I/O was assigned for the optional pre-set and catch inputs on the very fast counters. See *Very Fast Counters, p. 250* for more information.

Very Fast Counters

Introduction

This section provides basic information on the very fast counting special function.

Principle

The base controllers have five very fast counter types:
- An up/down counter with a maximum frequency of 20 kHz.
- An up/down 2-phase counter with a maximum frequency of 20 kHz.
- A single up counter with a maximum frequency of 20 kHz.
- A single down counter with a maximum frequency of 20 kHz.
- A frequency meter with a maximum frequency of 20 kHz.

The up/down counter, up/down 2-phase counter, single up counter, and single down counter functions enable counting of pulses from 0 to 65535 in single-word mode and pulses from 0 to 4294967296 in double-word mode. The frequency meter function measures the frequency of a periodic signal in Hz.

Controllers Very Fast Counting Capabilities

The number of very fast counters supported varies with the Twido controller models, as shown in the table below. Also, the availability of the double-word counting option depends on the controller model. The following table lists the very fast counting capabilities of the Twido line Compact and Modular controllers.

Twido Line Controllers	**Compact controllers TWDLC••...**				**Modular controllers TWDLMDA...**	
	10DRF	**16DRF**	**24DRF**	**40DRF**	**20D••**	**40D••**
Fast Counters	1	1	1	2	2	2
Single-Word	Yes	Yes	Yes	Yes	Yes	Yes
Double-Word	No	Yes	Yes	Yes	Yes	Yes

Digital I/O Assignment for a Very Fast Counter on all Controllers

The following tables lists the assigned I/O for one very fast counter on all controllers models.

Functions	First Input (pulses)	Second Input (pulses or Up/Down)	Pre-set Input	Catch Input	First Reflex Output	Second Reflex Output
Up/down counter	%I0.0.1 (pulses)	%I0.0.0*	%I0.0.2**	%I0.0.3**	%Q0.0.2**	%Q0.0.3**
Up/down 2-phase counter	%I0.0.1 (pulses Phase A)	%I0.0.0 (pulses Phase B)	%I0.0.2**	%I0.0.3**	%Q0.0.2**	%Q0.0.3**
Single Up Counter	%I0.0.1 (pulses)	Not used	%I0.0.2**	%I0.0.3**	%Q0.0.2**	%Q0.0.3**
Single Down Counter	%I0.0.1 (pulses)	Not used	%I0.0.2**	%I0.0.3**	%Q0.0.2**	%Q0.0.3**
Frequency Meter	%I0.0.1 (pulses)	Not used	Not used	Not used	Not used	Not used

Note:
- * Indicates up/down
- ** Optional use

Digital I/O Assignment for the Other Very Fast Counter on Modular Controllers

The following tables lists the assigned I/O for the other very fast counter on Modular controllers only.

Functions	First Input (pulses)	Second Input (pulses or Up/Down)	Pre-set Input	Catch Input	First Reflex Output	Second Reflex Output
Up/down counter	%I0.0.7 (pulses)	%I0.0.6*	%I0.0.5**	%I0.0.4**	%Q0.0.4**	%Q0.0.5**
Up/down 2-phase counter	%I0.0.7 (pulses Phase A)	%I0.0.6 (pulses Phase B)	%I0.0.5**	%I0.0.4**	%Q0.0.4**	%Q0.0.5**
Single Up Counter	%I0.0.7 (pulses)	Not used	%I0.0.5**	%I0.0.4**	%Q0.0.4**	%Q0.0.5**
Single Down Counter	%I0.0.7 (pulses)	Not used	%I0.0.5**	%I0.0.4**	%Q0.0.4**	%Q0.0.5**
Frequency Meter	%I0.0.7 (pulses)	Not used	Not used	Not used	Not used	Not used

Note:
- * Indicates up/down
- ** Optional use

Pulse (PLS) Generator Output

Introduction

This section provides basic information on the PLS special function.

Principle

The PLS is a special function that can be assigned to output %Q0.0.0 or %Q0.0.1 on a base or a peer controller. A user-defined function block generates a signal on output %Q0.0.0 or %Q0.0.1. This signal has a variable period but has a constant duty cycle, or on to off ratio of 50% of the period.

Controllers PLS Capabilities

The number of PLS generators supported varies with the Twido controller models, as shown in the table below. Note that all controllers that have a PLS generator support both single-word and double-word functions. The following table lists the PLS capabilities of the Twido line Compact and Modular controllers.

Twido Line Controllers	**Compact controllers TWDLC••...**				**Modular controllers TWDLMDA...**	
	10DRF	**16DRF**	**24DRF**	**40DRF**	**20D••**	**40D••**
PLS Generator	None	None	None	2	2	2
Single-Word	-	-	-	Yes	Yes	Yes
Double-Word	-	-	-	Yes	Yes	Yes

Pulse Width Modulation (PWM) Output

Introduction

This section provides basic information on the PWM special function.

Principle

The PWM is a special function that can be assigned to output %Q0.0.0 or %Q0.0.1 on a base or a peer controller. A user-defined function block generates a signal on output %Q0.00 or %Q0.0.1. This signal has a constant period with the possibility of varying the duty cycle, or on to off ratio.

Powering-Up and Troubleshooting

5

At a Glance

Introduction

This chapter provides the procedure for the first time a controller is powered-up, checking the I/O connections, and troubleshooting the controller using the LEDs.

What's in this Chapter?

This chapter contains the following topics:

Procedure for First Time Power-Up of a Controller

Introduction

This section explains powering-up a controller for the first time.

Power-Up Self Diagnostics

At power-up, the firmware will perform tests to ensure the proper functioning of the controller. Each major hardware component is tested for consistency. This includes the on-board PROM and RAM. Later in the booting sequence, the application is tested, using a checksum, before it can be executed.

First Time Power-Up Procedure

There are four status LEDs that signify the state and condition of the controller. The LED labeled PWR directly monitors the power supplied to the controller. It can not be changed by the application and can not be modified by the executive firmware. The first time the controller is powered up, it will be in a non-configured state with no application programming present. This state is indicated by a blinking ERR LED. If the ERR LED is not blinking or if any of the Input/Output LEDs are illuminated, without the presence of an external signal, see *Troubleshooting Using the Controller's LEDs, p. 258*.

Checking I/O Connections on the Base Controller

Introduction

This section provides a procedure for checking the I/O connections.

⚠ WARNING

UNINTENDED OPERATION OF EXTERNAL EQUIPMENT

To avoid unintended operation of external equipment, check that:
- Power fuses are removed from the motor controls.
- Pneumatic and hydraulic inputs are closed.

Failure to follow this instruction can result in death, serious injury, or equipment damage.

Checking I/O Connections Procedure

The following procedure ensures that the I/O connections are connected:

Step	Action
1	To test the I/O connections, the controller needs to be in the non-configured state. To accomplish this: ● If an Operator Display is attached, press and hold ESC and cycle the power on the controller. After the controller restarts, the Operator Display indicates "NCF". ● From TwidoSoft, issue the erase command from the Controller menu.
2	With the controller in the non-configured state, set system bit %S8 to 0. At state 0, the controller outputs are kept in their existing state.
3	Check the inputs by activating each external sensor. To accomplish this: ● Check that each of the input LEDs for the corresponding bit changes state. ● Using TwidoSoft's Operate Controller dialog, check that each of the input LEDs for the corresponding bit changes state.
4	Check the outputs by setting the bit corresponding to each output state to 1. To accomplish this: ● Check that each of the output LEDs for the corresponding bit changes state. ● Using TwidoSoft's Operate Controller dialog, check that each of the output LEDs for the corresponding bit changes state.
5	To complete this procedure, set system bit %S8 to 1. This is automatically accomplished by downloading a valid user application.

Troubleshooting Using the Controller's LEDs

Introduction This section provides information on the controller's operating status and troubleshooting using the LEDs.

Controller state The following table displays the different LED states on a base controller, peer controller, and remote controller.

LED state		Base Controller or Peer Controller	Remote I/O Controller
RUN green	○	Application not executed	Incorrectly or not connected
	⊗	Controller is in STOP mode or execution fault (HALT)	Same as base controller
	●	Controller is in RUN mode	Same as base controller
ERR red	○	OK	OK
	⊗	Application not executable, or execution error (HALT)	N/A
	●	Internal faults (watchdog, etc.)	Same as base controller
STAT green	○	Controlled by the user or application through system bit %S69	Same as base controller
	⊗	N/A	N/A
	●	Controlled by the user or application through system bit %S69	Same as base controller
BAT red	TWDLCAA40DRF and TWDLCAE40DRF Compact controllers. (For detailed information about the BAT LED status, please refer to *How to Install and Replace an External Battery, p. 241*.)		
	○	External battery power is OK or LED has been disabled. (Controlled by the user or system through system bit %S66)	N/A
	⊗	N/A	N/A
	●	No external battery or low battery power. Controlled by the user or system through system bit %S66	N/A
LAN ACT green/ amber	TWDLCAE40DRF Compact controller. (For detailed information about the LAN ACT LED status, please refer to (See TwidoSoft Operation Guide - Online Help).)		
	○	No Ethernet signal.	N/A
	⊗	green: communicating over 10Base-T link. amber: communicating over 100Base-TX link.	N/A
	●	green: 10Base-T network connection. amber: 100Base-TX network connection.	N/A

LED state		Base Controller or Peer Controller	Remote I/O Controller
LAN ST green	TWDLCAE40DRF Compact controller. (For detailed information about the LAN ACT LED status, please refer to (See TwidoSoft Operation Guide - Online Help).)		
	◯	Base controller is powered OFF.	N/A
	⊗	Multiple, consecutive flashes of various numbers to provide a visual diagnostic tool of the Ethernet network connection status.	N/A
	●	Base controller is powered ON. Ethernet port is ready.	N/A
◯ Off		⊗ Flashing	● Illuminated

Status of the Digital I/O Module

LED state		Digital I/O Module
I/O LEDs	◯	I/O not active
	●	I/O active
◯ Off		● Illuminated

Status of AS-Interface bus interface module

The following table summarizes the problems that may occur on AS-Interface master module startup:

Problems		Causes and action to be taken
PWR	◯	Insufficient power is being delivered to the AS-Interface module. ● Check AS-Interface power supply and connections. ● Check the connection between the Twido module and the AS-Interface master.
FLT	●	The slave configuration on the AS-Interface bus is incorrect: ● Use TwidoSoft to check that the slaves are correctly connected. If the configuration is correct and the LED remains on: ● Disconnect and reconnect the AS-Interface connector, or switch off the power supply and switch it back on again.
OFF	●	A slave is connected at address 0 at power up: ● Change the slave's address and repeat power up:
Instable slave operation		If two slaves have the same address and the same identity codes, the AS-Interface master may fail to detect an error: ● Remove one of the slaves from the bus and perform readdressing using TwidoSoft.
◯ Off	● Illuminated	

CANopen Status LED

The following table describes the CANopen status LED:

CANopen LED state		Possible causes and actions
ON (Solid)	◯	Bus On (no error)
ON (Blinking)	⊗	Bus initialization in progress (at startup)
OFF	●	Bus Off *Possible causes:* ● either the CANopen master module is not powered normally, ● or the bus configuration is invalid. (See also %SW81...87 and %SW20...27 system words to check operating status of CANopen master and slave devices respectively, in *Twido Software Reference Guide*.)
◯ Off	⊗ Blinking	● Illuminated

Agency Compliance

6

Agency Requirements

Introduction

This section provides agency standards for the Twido products.

Standards

Twido controllers comply with the main national and international standards concerning electronic industrial control devices.
The following are specific controller requirements:

- EN61131-2 (IEC61131-2)
- UL508
- UL1604/CSA 213 Class I Division 2 Groups A, B, C, D

Appendices

At a Glance

Introduction

This appendix provides information on common IEC symbols used in this manual.

What's in this Appendix?

The appendix contains the following chapters:

IEC Symbols

A

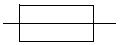
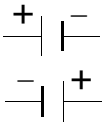
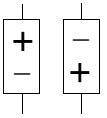
Glossary of Symbols

Introduction

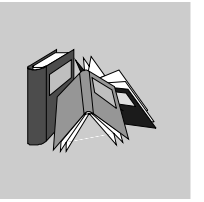
This section contains illustrations and definitions of common IEC symbols used in describing wiring schematics.

Symbols

Common IEC symbols are illustrated and defined in the table below:

	Fuse
	Load
	AC power
	DC power
	Digital sensor/input, for example, contact, switch, initiator, light barrier, and so on.
	Earth ground
	2-wire sensor
	Thermocouple element

Glossary



A

Analog potentiometer
It can be used to preset a value for an analog timer. All Modular controllers and Compact 10 and 16 I/O controllers have one analog potentiometer. The Compact 24 I/O controller has two:

Analog Voltage Input Connector
Connects an analog voltage source of 0 through 10 VDC. The analog voltage is converted to a digital value and is stored in a system word.

C

CAN
Controller Area Network: field bus originally developed for automobile applications which is now used in many sectors, from industrial to tertiary.

Cartridge Connector
A connector to attach an optional memory cartridge or an RTC.

Catch Input
Makes sure to receive short input pulses (rising pulse of 40 µs or falling pulse of 150 µs minimum) from sensors without regard to the scan time.

CiA
CAN in Automation: international organization of users and manufacturers of CAN products.

COB	**Communication OBject**: transport unit on CAN bus. A COB is identified by a unique identifier, which is coded on 11 bits, [0, 2047]. A COB contains a maximum of 8 data bytes. The priority of a COB transmission is shown by its identifier - the weaker the identifier, the more priority the associated COB has.
Communication Adapter	An optional cartridge that can be attached to any Compact controller or Operator Display Expansion Module to provide an optional Serial Port 2.
Communication Expansion Module	An optional module that can be attached to any Modular controllers communications expansion bus to provide an optional Serial Port 2.
Controller status output	A special function. This function is used in safety circuits, external to the controller, to control the power supply to the output devices or the controller power supply.

E

EDS	**Electronic Data Sheet**: description file for each CAN device (provided by the manufacturers).
ERR LED	An LED that illuminates when an error occurs in the controller.
Expansion connector	A connector to attach expansion I/O modules.
Expansion Connector Cover	A cover to protect the expansion connector.
Expansion I/O Module	Either a digital or analog module that adds additional I/O to the base controller.

F

Fast Counting	A special function, it is available as a single up counter and single down counter. These functions enable up counting or down counting of pulses (rising edges)on a digital I/O. Compact controllers can be equipped with three fast counters. Modular controllers can have two fast counters.

Free Wire The end of a digital I/O cable whose wires do not have a connector. This scheme provides connectivity from Modular I/O to discrete I/O points.

I

I/O Input/Output.

I/O terminals Terminals on all Modular controllers and expansion I/O modules used to connect input and output signals. The input terminals accept both sink and source DC input signals. The output terminals are either transistor source or sink or relay contacts.

IN LED An LED that illuminates when a corresponding input is on. All modules have IN LEDs.

Input Filter A special function that rejects input noises. This function is useful for eliminating input noises and chatter in limit switches. All inputs provide a level of input filtering using the hardware. Additional filtering using the software is also configurable through TwidoSoft.

Input Simulators An optional accessory for Compact controllers that is used for debugging. It can simulate input sensors to test application logic.

Input terminals Terminals on the top of all Compact controllers used to connect input signals from input devices such as sensors, push buttons, and limit switches. The input terminals accept both sink and source DC input signals.

L

Latching input A special function. This function is used to memorize any pulse with a duration less than the controller scan time. When a pulse is shorter than one scan and has a value greater than or equal to 100 µs, the controller latches the pulse, which is then updated in the next scan.

M

Memory Cartridge — An optional cartridge available in two sizes: 32 KB and 64 KB (64 KB not available on Compact). It can be added to any controller for removable backup of applications or to load an application, if certain conditions exist. The 64 KB cartridge is also used to increase program memory.

Modbus Master Mode — Allows the controller to initiate a Modbus query transmission, with a response expected from a Modbus slave.

Modbus Slave Mode — Allows the controller to respond to Modbus queries from a Modbus master and is the default communications mode if no communication is configured.

O

Operator display expansion module — An optional module that can be attached to any Modular controller to display program information.

Operator display module — An optional module that can be attached to any Compact controller to display program information.

OUT LED — An LED that illuminates when a corresponding output is on. All modules have OUT LEDs.

Output terminals — Terminals on the bottom of all Compact controllers used to connect output signals from output devices such as electromechanical relays and solenoid valves. The internal output relay contact is rated up to 240 VAC/2A or 30 VDC/2A.

P

PLS — A special function. This user-defined function block generates a signal on output %Q0.0.0 or %Q0.0.1. This signal has a variable period but has a constant duty cycle, or on to off ratio of 50% of the period.

Power Supply Terminals	The power supply is connected to these terminals to provide power to the controller. The power voltage for a Compact controller is 100-240 VAC and 24 VDC for a Modular controller.
PWM	A special function. This user-defined function block generates a signal on output %Q0.0.0 or %Q0.0.1. This signal has a constant period with the possibility of varying the duty cycle, or on to off ratio.
PWR LED	An LED that illuminates when power is supplied to the controller.

R

Removable Cover	A cover on all Compact controllers that can be removed to install an optional Operator Display.
RTC	Real Time Clock.
RTD	Temperature detector of type PT100, PT1000 etc. Resistor Temperature Detector.
RUN LED	An LED that illuminates when the controller is executing a program.

S

Sensor power terminals	Supplies power to the sensors (24 VDC, 400 mA for -40DRF compact controllers and 250 mA for all other controllers). Output terminals are only intended for input devices and should not be used as a source for driving external loads.
Serial Port 1	An EIA RS-485 connector used to download and monitor the controller operation using TwidoSoft.
Serial port 2	An optional port that can be configured as either EIA RS-232 or EIA RS-485.
STAT LED	An LED that blinks on and off to indicate a specific status of the user program.

T

Terminal cover A cover on all Compact controllers to protect the input and output terminals.

V

Very Fast Counting A special function available as an up/down counter, an up/down 2-phase counter, a single up counter, a single down counter, and frequency meter. The counter functions enable counting of pulses from 0 to 65,535 in single-word mode and from 0 to 4,294,967,295 in double-word mode. The frequency meter function measures the frequency of a periodic signal in Hz.

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