Twido
Programmable Controllers
Hardware Guide
Modular and Compact Bases

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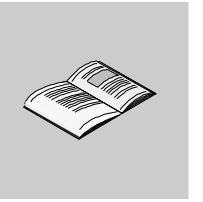
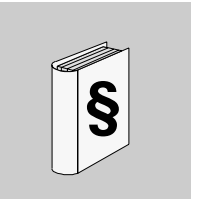


Safety Information



Important Information

NOTICE

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

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

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

⚠ DANGER

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

⚠ WARNING

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

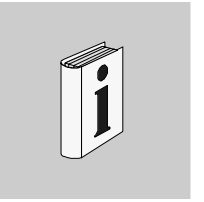
⚠ CAUTION

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

PLEASE NOTE

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

About the Book



At a Glance

Document Scope This is the Hardware Guide for Twido programmable controllers for compact modular bases.

Validity Note The information in this manual is applicable **only** for Twido programmable controllers.

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

Related Documents

Title of Documentation	Reference Number
The Twido Programmable Controllers Hardware Guide for Discrete I/O Modules	3501138800
The Twido Programmable Controllers Hardware Guide for Analog I/O Modules	3501138900
The Twido Programmable Controllers Hardware Guide for Communication Modules	3501139000
The Twido Programmable Controllers Programming Guide	3501138600
The TwidoSuite Programming Software Online Help	–
The Twido Windows Executive Loader Wizard Online Help	–
The Twido Programming Softwar- Getting Started	3501138500

Product Related Warnings

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

When controllers are used for applications with technical safety requirements, please follow the relevant instructions.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this product related warning can result in injury or equipment damage.

User Comments

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Twido Hardware Guide - Compact & Modular Bases

I

At a Glance

Introduction

This part of the guide provides parts descriptions, specifications, wiring schematics, installation, set up, and troubleshooting information about all Twido compact & modular bases.

What's in this Part?

This part contains the following chapters:

Twido Overview

1

At a Glance

Introduction

This chapter provides an overview of the Twido products, the maximum configurations, the main functions of the bases, 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 the two following models:

- Compact Bases
- Modular Bases

Compact bases are available with 10, 16, 24 or 40 I/Os.

Modular bases are available with either 20 or 40 I/Os.

Additional I/O can be added to the bases using expansion I/O modules. They are:

- 15 expansion modules for discrete I/O or relay type
- 9 expansion modules for the analog I/O type

There are also several options that can be added to the bases as in the table from the Bases Options (See *Bases Options, p. 16*) paragraph below.

In addition to these options, other options listed below can be added:

- Programming cables (See *, p. 17*)
- Discrete I/O cables
- Telefast pre-wired systems with I/O interfaces (See *Overview of the Telefast®* Pre-Wired System for Twido, p. 162)

Connection to Communication modules

Connecting to an AS-Interface bus interface module also permits 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 bases and all modular bases can connect to a CANopen fieldbus interface module. The CANopen master module permits 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.

Advanced Features for TWDLCAA40DRF and TWDLCAE40DRF Compact Bases

Advanced integrated features are provided on the TWDLCAA40DRF and TWDLCAE40DRF series compact bases:

- 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

Bases Models The following table lists the bases:

Base 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	

Bases Options The following table lists the options:

Option name	Reference
Operator display module (Compact bases only)	TWDXCPODC
Operator display expansion module (Modular bases only)	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 (Modular bases only)	TWDNOZ485D
Communication expansion module, RS232, miniDIN (Modular bases only	TWDNOZ232D
Communication expansion module, RS485, terminal (Modular bases only)	TWDNOZ485T
ConneXium TwidoPort Ethernet interface module (except for TWDLCAE40DRF with on-board Ethernet interface)	499TWD01100
6-point input simulator (Compact bases only)	TWDXSM6
9-point input simulator (Compact bases only)	TWDXSM9
14-point input simulator (Compact bases only)	TWDXSM14
External backup battery (TWDLCA•40DRF only)	TSXPLP01 (single battery order) TSXPLP101 (10 pack order)
5 mounting strips	TWDDXMT5
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
Ethernet Connection Cable	
SFTP Cat5 RJ45 Ethernet cable	490NTW000••

Maximum Hardware Configuration for Compact Bases

Introduction

This section provides the maximum hardware configurations for a compact base.

Maximum Hardware Configurations

The following tables list the maximum number of configuration items for each type of compact base:

Base specifics:

Base Item	Compact base			
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 serial port	no	yes	yes	yes
Optional Ethernet interface module	yes	yes	yes	yes (TWDLC-AA40DRF) no (TWDLC-AE40DRF)

Note:
1. A Compact base 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 bases have a built-in RTC. Therefore, no RTC cartridge can be added on those controllers, but only a memory cartridge.

Discrete I/O expansions:

Base Item	Compact base			
TWD...	**LCAA10DRF LCDA10DRF**	**LCAA16DRF LCDA16DRF**	**LCAA24DRF LCDA24DRF**	**LCAA40DRF LCAE40DRF**
Standard discrete inputs	6	9	14	24
Standard discrete outputs	4	7	10	16 (14 Relay + 2 Transistor outputs)
Max expansion I/O modules (Discrete or analog)	0	0	4	7
Max discrete inputs (controller I/O + exp I/O)	6	9	14+(4x32)=142	24+(7x32)=248
Max discrete 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 relay outputs	4 base only	7 base only	10 base + 32 expansion	14 base + 96 expansion
Potentiometers	1	1	2	2

Analog I/O expansions:

Base Item	Compact base			
TWD...	**LCAA10DRF LCDA10DRF**	**LCAA16DRF LCDA16DRF**	**LCAA24DRF LCDA24DRF**	**LCAA40DRF LCAE40DRF**
Built-in analog inputs	0	0	0	0
Max analog I/O (controller I/O + exp I/O)	0 in or 0 out	0 in or 0 out	32 in or 8 out	56 in / 14 out

Communication modules:

Base Item	Compact base			
TWD...	**LCAA10DRF LCDA10DRF**	**LCAA16DRF LCDA16DRF**	**LCAA24DRF LCDA24DRF**	**LCAA40DRF LCAE40DRF**
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 interface modules	0	0	1	1
Max T/R-PDOs with CANopen devices	0	0	16 TPDOs 16 RPDOs	16 TPDOs 16 RPDOs
Remote controllers	7	7	7	7

Maximum Hardware Configuration for Modular Bases

Introduction

This section provides the maximum hardware configurations for a modular base.

Maximum Hardware Configurations

The following tables list the maximum number of configuration items for each type of modular base:

Base specifics:

Base Item	Modular base		
TWD...	**LMDA20DUK LMDA20DTK**	**LMDA20DRT**	**LMDA40DUK LMDA40DTK**
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[1]	yes[1]	yes[1]
Optional Ethernet interface module	yes	yes	yes

Note:
1. A modular base can have either an Operator Display expansion module (with an optional communication adapter) or a communication expansion module.

Discrete I/O expansions:

Base Item	Modular base		
TWD...	**LMDA20DUK LMDA20DTK**	**LMDA20DRT**	**LMDA40DUK LMDA40DTK**
Standard discrete inputs	12	12	24
Standard discrete outputs	8	8	16
Max expansion I/O modules (Discrete or analog)	4	7	7
Max discrete inputs (controller I/O + exp I/O)	12+(4x32)=140	12+(7x32)=236	24+(7x32)=248
Max discrete 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 relay outputs	64 expansion only	6 base + 96 expansion	96 expansion only
Potentiometers	1	1	1

Analog I/O expansions:

Base Item	Modular base		
TWD...	**LMDA20DUK LMDA20DTK**	**LMDA20DRT**	**LMDA40DUK LMDA40DTK**
Built-in analog inputs	1	1	1
Max analog I/O (controller I/O + exp I/O)	33 in or 1 in and 4 out	57 in or 1 in and 14 out	57 in or 1 in and 14 out

Communication modules:

Base Item	Modular base		
TWD...	**LMDA20DUK LMDA20DTK**	**LMDA20DRT**	**LMDA40DUK LMDA40DTK**
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
Remote controllers	7	7	7

Main Features of the Controllers

Introduction

By default all I/Os on the bases are configured as discrete I/Os. However, certain dedicated I/Os (See *Dedicated I/Os, p. 181*) 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 TwidoSuite which also enables the PID and PID Auto-Tuning functions to be used on certain controllers:

Main Features

The following table lists the main features of the bases:

Feature	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 bases 128 memory bits for TWDLCAA10DRF and TWDLCAA16DRF 256 memory bits for all other bases.
	Program: 10 I/O compact base: 700 list instructions 16 I/O compact base: 2000 list instructions 24 I/O compact, and 20 I/O modular bases: 3000 list instructions 20 I/O modular and 40 I/O modular bases, and 40 I/O compact bases: 6000 list instructions (with a 64 Kb cartridge, otherwise 3000 list instructions)
RAM backup	All bases: 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 bases: 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 base (typically, no long-term powering off of the base). BAT LED on front-panel provides indication of status for battery-power.

Feature	Description	
Programming port	All bases: EIA RS-485 TWDLCAE40DRF compact base: Built-in RJ45 Ethernet communications port	
Expansion I/O modules	10 and 16 I/O compact bases: no expansion modules 24 I/O compact and 20 I/O modular bases: up to 4 expansion I/O modules 40 I/O modular and 40 I/O compact bases: up to 7 expansion I/O modules	
AS-Interface V2 bus interface modules	10 and 16 I/O compact bases: no AS-Interface bus interface module 24 I/O and 40 I/O compact, 20 I/O and 40 I/O modular bases: up to 2 AS-Interface bus interface modules	
CANopen fieldbus interface modules	10 and 16 I/O compact bases: no CANopen fieldbus interface module 24 I/O and 40 I/O compact, 20 I/O and 40 I/O modular bases: 1 CANopen fieldbus interface module	
Remote link communication	Maximum 7 slaves by remote I/O or peer bases. 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 base 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	Fast counters	TWDLCA•40DRF Compact bases: 4 All other compact bases: 3 All modular bases: 2
	Very fast counters	TWDLCA•40DRF compact bases: 2 All other compact bases: 1 All modular bases: 2
	PWM/PLS	All modular and 40 I/O compact bases: 2
Analog potentiometers	24 I/O and 40 I/O compact bases: 2 All other bases: 1	
Built-in analog channel	Compact bases: none Modular bases: 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	

Feature	Description	
Special I/O	Inputs	RUN/STOP: Any one of the base inputs
		Latching: up to 4 inputs (%I0.2 to %I0.5)
		0-10 V built-in analog input connected to %IW0.0.0
		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)
		PWM: 7 kHz maximum
		PLS: 7 kHz maximum

Communication Overview

Introduction

Twido bases have one, or an optional second, serial port that is used for real-time or system management services.

Four types of communications can be used with Twido controllers:

- AS-Interface bus connection
- CANopen fieldbus connection
- Ethernet Network connection
- Modem connection

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 base through TwidoSuite. Either serial port is used for any of these services but only serial port 1 is for communicating with TwidoSuite.

To provide these services, there are three protocols available on each base:

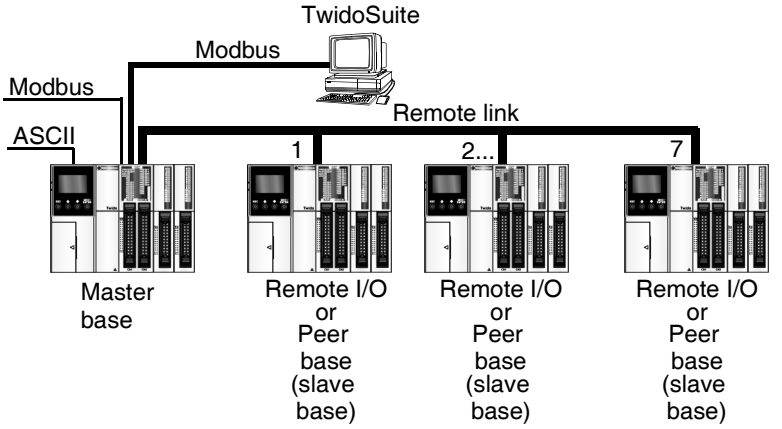
- Remote Link
- Modbus
- ASCII

In addition, the TWDLCAE40DRF compact base 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 with the protocols

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.

AS-Interface Connection

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.

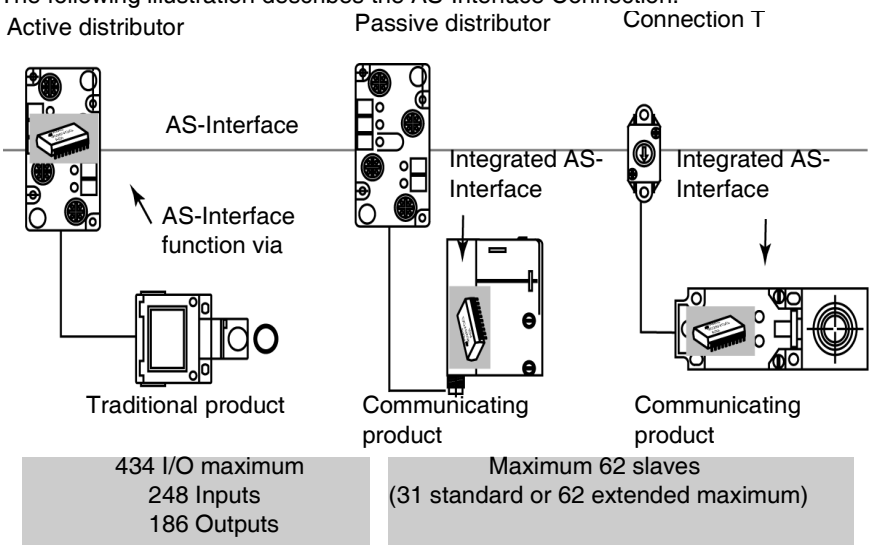
AS-Interface is made up of three major basic elements:

- 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.

AS-Interface Connection Illustration

The following illustration describes the AS-Interface Connection:



CANopen Fieldbus Connection

The CAN open architecture of a Twido system consists of:

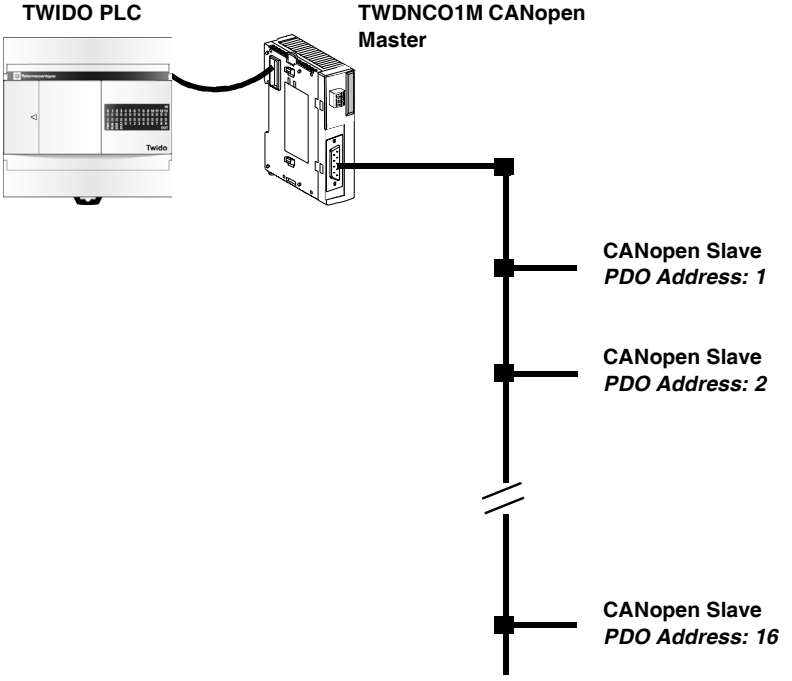
- a Twido PLC (compact base or modular base)[1],
- a CANopen fieldbus master module (TWDNCO1M module) installed on the Twido PLC's expansion bus[2],
- CANopen slave devices[3,4].

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 CANopen slave devices.

Twido CANopen Fieldbus Topology

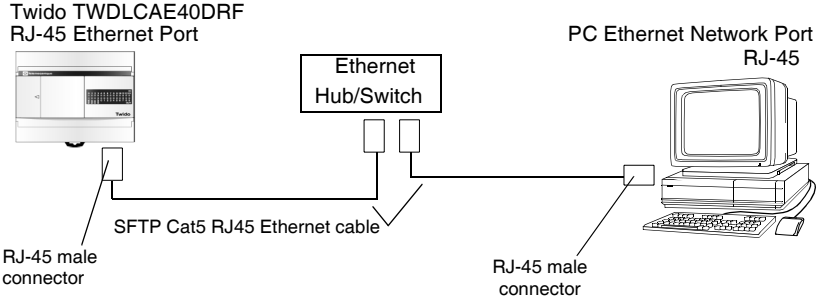
The following figure shows the Twido CANopen fieldbus topology:



Ethernet Network Connection

Note: Although direct cable connection (using a Ethernet crossover cable) is supported between the Twido TWDLCAE40DRF and the PC running the TwidoSuite programming software, we do not recommend it. Therefore, you should always favor a connection via a network Ethernet hub/switch.

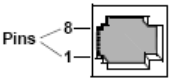
The following figure shows a PC-to-Twido connection via a network Ethernet hub/switch:



Note: The PC running the TwidoSuite application must be Ethernet-capable.

The Twido TWDLCAE40DRF features a RJ-45 connector to connect to the 100 BASE-TX network Ethernet with auto negotiation. It can accomodate both 100Mbps and 10 Mbps network speeds.

The following figure shows the RJ-45 connector of the Twido controller:



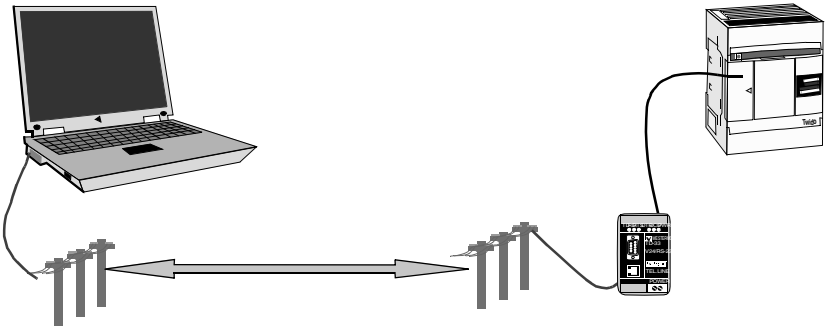
The eight pins of the RJ-45 connector are arranged vertically and numbered in order from bottom to top. The pinout for the RJ-45 connector is described in the table below:

Pinout	Function	Polarity
8	NC	
7	NC	
6	RxD	(-)
5	NC	
4	NC	
3	RxD	(+)
2	TxD	(-)
1	TxD	(+)

Note:
- The same connector and pinout is used for both 10Base-T and 100Base-TX.
- When connecting the Twido controller to a 100Base-TX network, you should use at least a category 5 Ethernet cable.

Modem Connection

A PC executing TwidoSuite can be connected to a Twido controller for transferring applications, animating objects and executing operator mode commands. It is also possible to connect a Twido controller to other devices, such as another Twido controller, for establishing communication with the application process.



Installation

2

At a Glance

Introduction

This chapter provides installation overall instructions with safety information and installation preparation, installation and mounting instructions for the compact bases, for the modular bases, and for their options, and how to connect the power supply.

What's in this Chapter?

This chapter contains the following sections:

2.1 Installation Overall Instructions

At a Glance

Introduction

This section provides information for installation preparation, safety, how to assemble and disassemble bases and modules, and minimum clearances for bases and modules.

What's in this Section?

This section contains the following topics:

Installation Safety Guidelines

NOTICE

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 TwidoSuite 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.

Installation Preparation

Introduction

The following section provides information on preparation for all TwidoSuite bases and expansion I/O modules.

Before Starting

Before installing any of the TwidoSuite products read the Safety Information at the beginning of this book.

⚠ CAUTION

EQUIPMENT DAMAGE

Before adding/removing any module or adapter, turn off the power to the base. Otherwise, the module, adapter, or base may be damaged, or the base may not operate correctly.

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

Note: All options, expansion I/Os, 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.

Compact and Modular Bases Mounting Positions

Introduction

This section shows the correct and incorrect mounting positions for all bases.

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

⚠ CAUTION

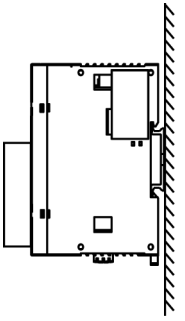
OVERHEATING HAZARD

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

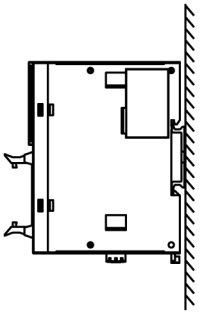
Failure to follow this instruction can result in injury or equipment damage.

Correct Mounting Position for all Bases

Compact and Modular bases must be mounted horizontally on a vertical plane as shown in the figures below.



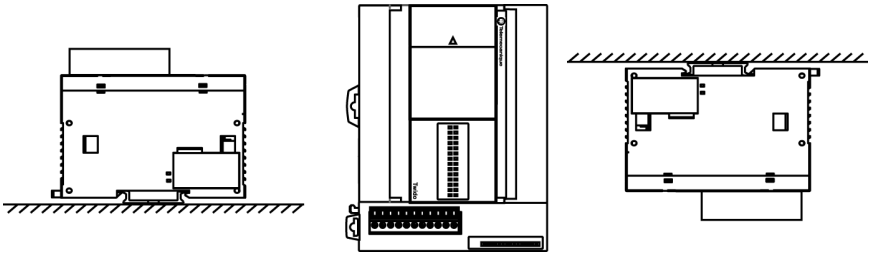
Compact base with an expansion I/O module



Modular base with an expansion I/O module

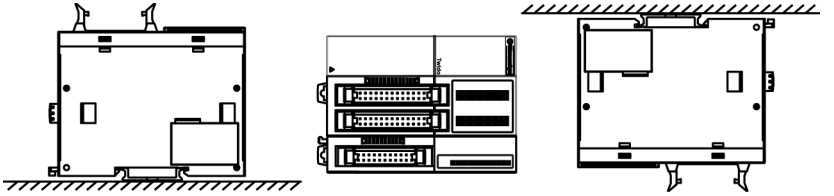
Correct and Incorrect Mounting Positions for Compact Bases

A Compact base should only be positioned as shown in "Correct Mounting Position for all Bases" figure. When the ambient temperature is 35°C (95°F) or below, the Compact base can also be mounted upright on a horizontal plane as shown in (1). When the ambient temperature is 40°C (104°F) or below, the Compact base 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 Modular Bases

A Modular base should only be positioned as shown in "Correct Mounting Position for all Bases" figure. The figures below show the incorrect mounting positions for all Modular bases.



Assembling an expansion I/O module to a base

Introduction

This section shows how to assemble an expansion I/O module to a base. This procedure is for both Compact and Modular bases. Your base and expansion I/O module may differ from the illustrations in this procedure.

⚠ WARNING

UNEXPECTED EQUIPMENT OPERATION

Make sure that you update the software each time you change the hardware configuration of the I/O expansion bus. Otherwise, the expansion bus will no longer operate while the local base inputs and outputs will continue to operate.

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

Assembling an Expansion I/O Module to a Base.

The following procedure shows how to assemble a base and an expansion I/O module together.

Step	Action
1	Remove the expansion connector cover from the base.
2	Make sure the black latch button on the I/O module is in the up position. 
3	Align the connector on the left side of the Expansion I/O module with the connector on the right side of the base. 
4	Press the expansion I/O module to the base until it "clicks" into place.
5	Push down the black latch button on the top of the expansion I/O module to lock the module to the base.

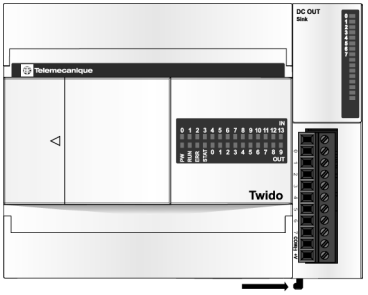
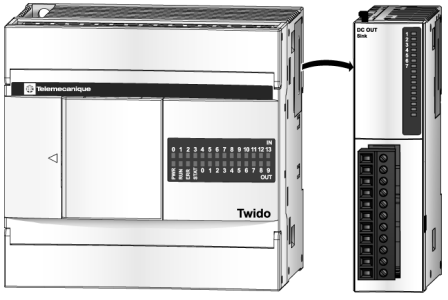
Disassembling an Expansion I/O Module from a Base

Introduction

This section describes how to disassemble an expansion I/O module from a base. This procedure is for both Compact and Modular bases. Your base and expansion I/O module may differ from the illustrations in these procedures but the basic mechanism procedures are still applicable.

Disassembling an Expansion I/O Module from a Base.

The following procedure describes how to disassemble an expansion I/O module from a base.

Step	Action
1	Remove the assembled base and module from the DIN rail before disassembling them, see *The DIN Rail, p. 229*.
2	Push up the black latch from the bottom of the expansion I/O module to disengage it from the base. 
3	Pull apart the base and module. 

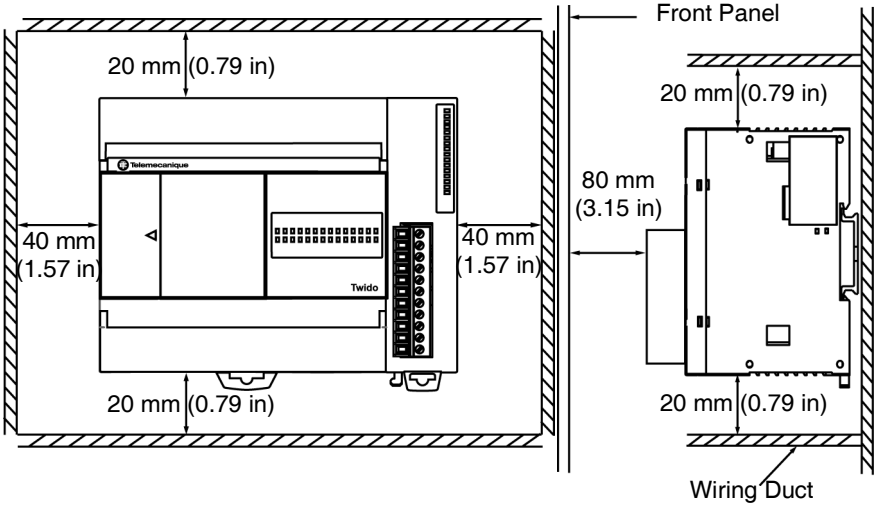
Minimum Clearances for Bases and Expansion I/O Modules in a Control Panel

Introduction

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

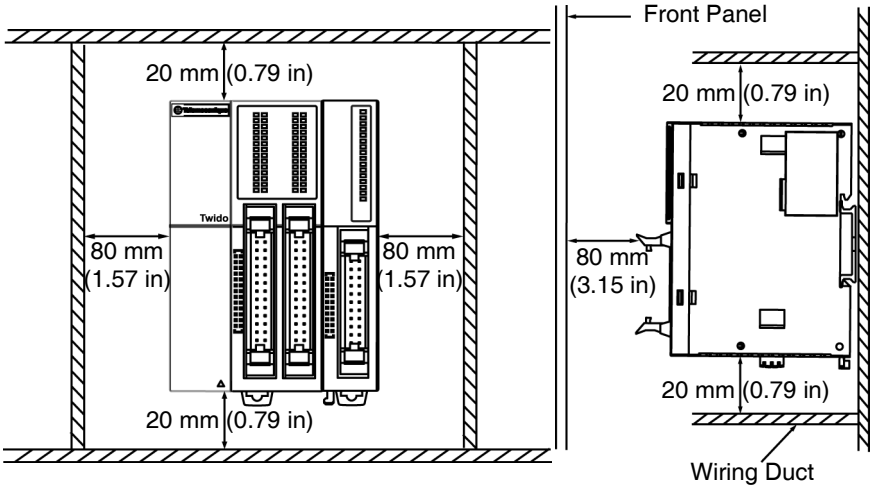
Minimum Clearances for a Compact Base and Expansion I/O Modules

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



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

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



2.2 Compact Bases Installation

At a Glance

Introduction

This section provides information for installing Compact bases.

What's in this Section?

This section contains the following topics:

Dimensions of the Compact Bases

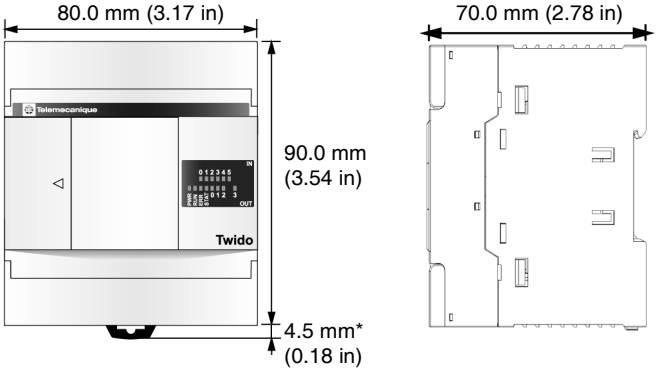
Introduction

The following section shows the dimensions for all Compact bases.

TWDLC•A10-DRF and TWDLC•A16-DRF

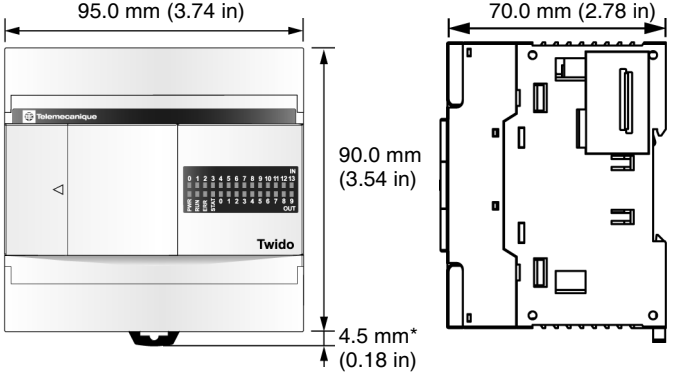
The following diagrams show the dimensions for the TWDLC•A10DRF and TWDLC•A16DRF series Compact bases.

Illustration showing TWDLC•A10DRF series base:

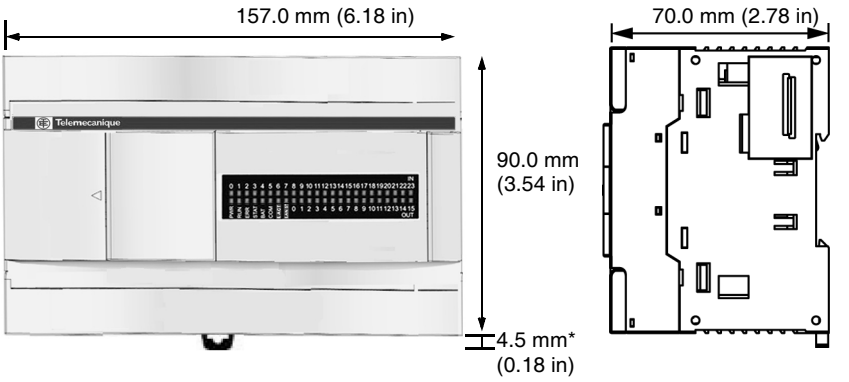


TWDLC•A24-DRF

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



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



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

How to Direct Mount a Compact Base on a Panel Surface

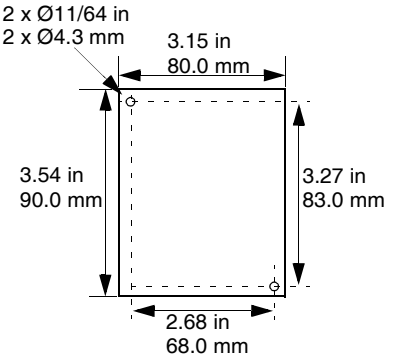
Introduction

This section also provides mounting hole layouts for a Compact base and module. Your base or module may differ from the illustrations in these procedures but the basic mechanism procedures are applicable.

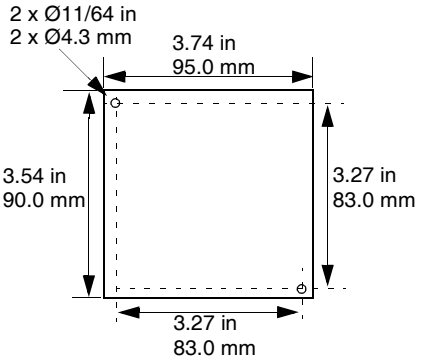
Mounting Hole Layout for Compact Bases

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

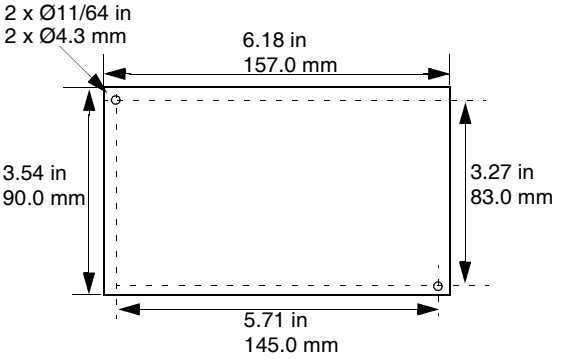
TWDLC•A10DRF
TWDLC•A16DRF



TWDLC•A24DRF



TWDLCA•40DRF



How to Install and Remove a Compact Base from a DIN Rail

Introduction

This section describes how to install and remove compact bases 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.

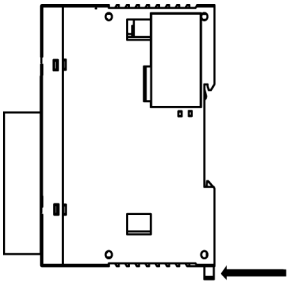
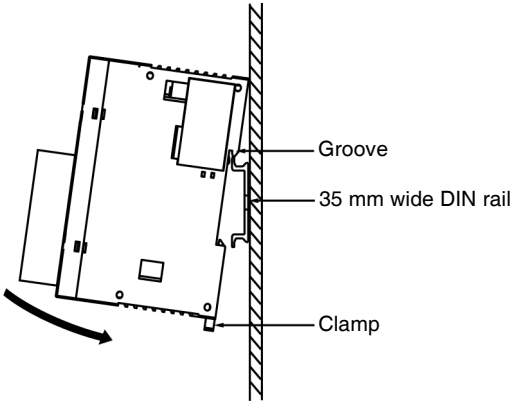
Note: When mounting compact bases on a DIN rail, use two end stops, type AB1-AB8P35 or equivalent.

For additional information about the DIN rail,

see The DIN Rail. *The DIN Rail, p. 229*

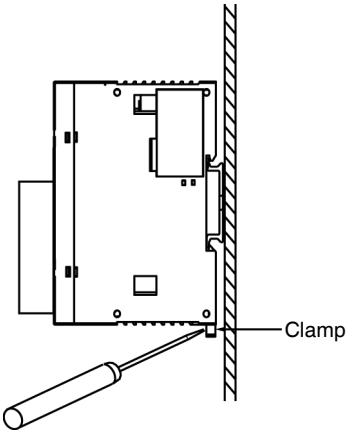
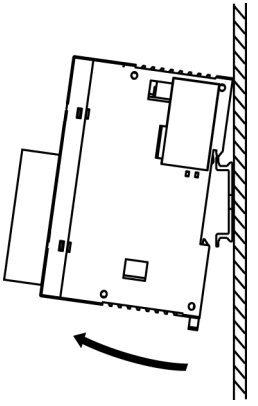
How to Install a Compact Base on a DIN Rail

The following procedure shows how to install a compact base 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 compact base and module assembly. 
3	Put the top groove of the compact base 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 Compact Base from a DIN Rail

The following procedure shows how to remove a compact base 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 compact base and the associated module off the DIN rail from the bottom. 

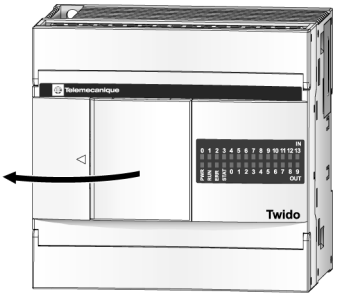
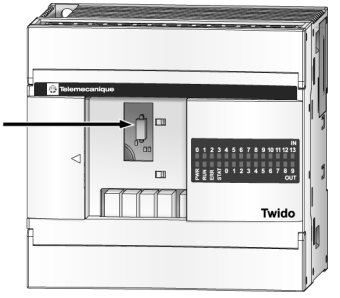
How to Install the Operator Display Module

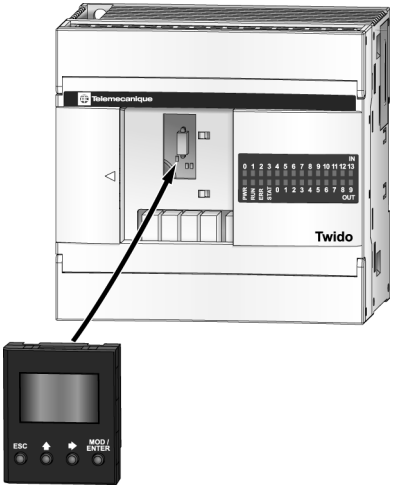
Introduction

This section describes installation of the TWDXCPODC operator display module.

Installing the Operator Display Module into a Compact Base

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

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

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

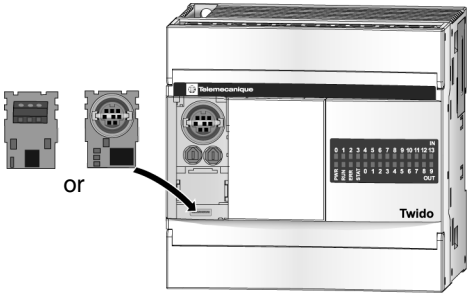
How to Install a Serial Interface Adapter to a Compact Base

Introduction

This section shows how to install the TWDNAC232D, TWDNAC485D, or TWDNAC485T serial interface adapter into the port 2 in a Compact base. Your base may differ from the illustrations in these procedures but the basic mechanism procedures are applicable.

How to Install the Serial Interface Adapter into the Port 2 in a Compact Base

The following procedure shows how to install the TWDNAC232D, TWDNAC485D, or TWDNAC485T serial interface adapter into the port 2 in a Compact base.

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

How to Install a Memory or RTC Cartridge in a Compact base

Introduction

This section shows how to install the TWDXCPMFK32 memory cartridge, the TWDXCPMFK64 memory cartridge (only for TWDLCAA40DRF and TWDLCDA40DRF) and the TWDXCPRTC RTC cartridge in a Compact base.

Installing a Cartridge in a Compact Base

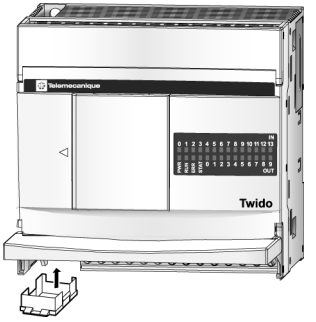
The following procedure shows how to install the TWDXCPMFK32 memory, the TWDXCPMFK64 memory (only for TWDLCAA40DRF and TWDLCDA40DRF) or the TWDXCPRTC RTC cartridge in a Compact base. Only one of these cartridges can be installed in the Compact base.

⚠ CAUTION

EQUIPMENT DAMAGE

When handling the cartridges, do not touch the pins. The cartridge 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.

How to Connect the Power Supply to Compact Bases

Introduction

This section describes how to connect the power supply to the Compact bases.

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

⚠ CAUTION

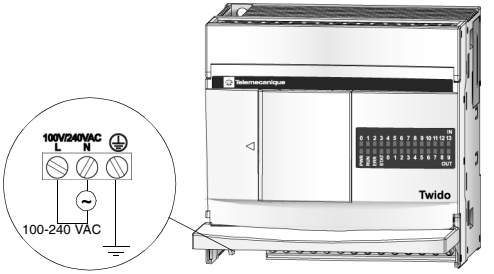
INCOMPATIBLE OR IMPROPER POWER SUPPLY CONNECTIONS

- 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.

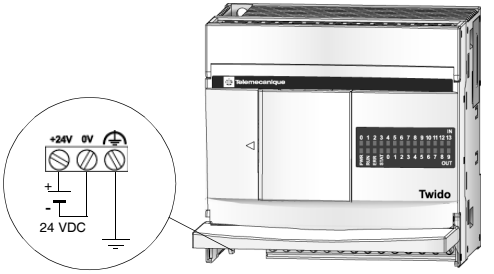
Connect an AC Power Supply to a Compact Base

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



Connect a DC Power Supply to a Compact Base

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



Compact Base Power Supply Specifications

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

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.	

How to Install and Replace an External Battery

Note: The following information about the external battery applies to TWDLCAA40DRF and TWDLCAE40DRF series compact bases only. If you own another model of compact base, 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 bases 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 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 base; you must purchase it separately. Please use part number TSXPLP01 to order a single battery or TSXPLP101 to order a 10 pack.

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

FIRE OR CHEMICAL HAZARD

The Lithium batteries used in this device may present a risk of fire or chemical burn if not handled properly

- Do not recharge, disassemble, heat above 212 °F (100 °C), or incinerate.
- Recycle or properly dispose of used batteries.
- Replace with identical type :TSXPLP01 (Tadiran, TL-5902) only.
- Follow all battery manufacturers' instructions.

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

Battery Power Status

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

LED State	Description
Off	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

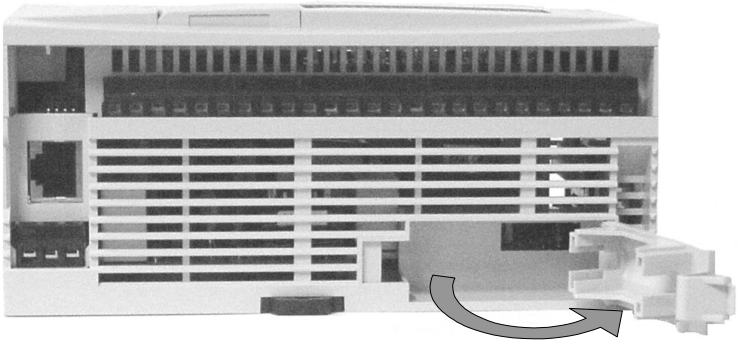
When installing or replacing the external battery, make sure the following two conditions are both met:

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 base 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 base case. To install or replace an external battery, follow these steps:

Step	Action
1	Before installing or replacing the external battery, you must first make sure that the internal battery of your Twido base 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 base immediately to preserve battery life.

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.

2.3 Modular Bases Installation

At a Glance

Introduction

This section provides Information about installing Modular bases.

What's in this Section?

This section contains the following topics:

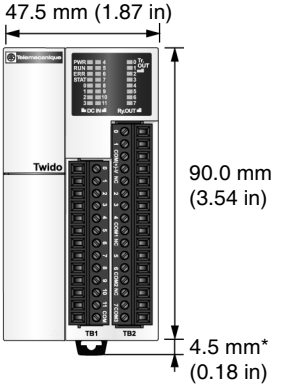
Dimensions for the Modular Controllers

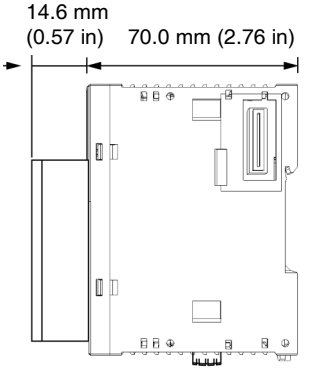
Introduction

The following section shows the dimensions for all Modular controllers.

TWDLMDA20-DRT Dimensions

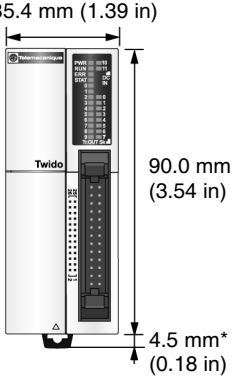
The following diagrams show the dimensions for the TWDLMDA20DRT Modular base.

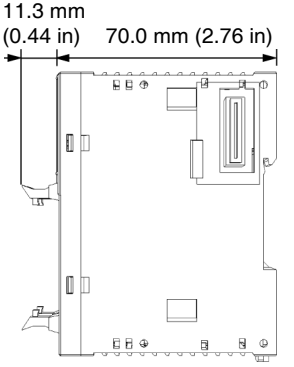




TWDLMDA20-DUK and TWDLMDA20-DTK Dimensions

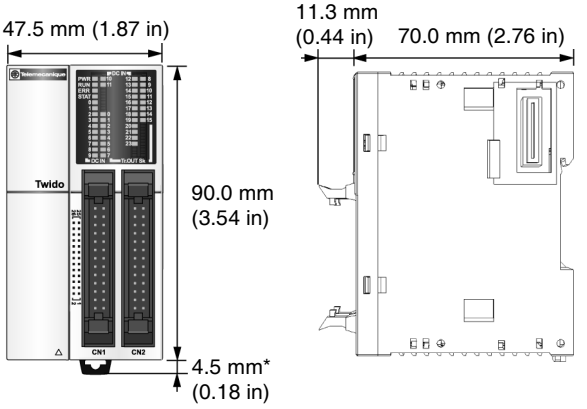
The following diagrams show the dimensions for the TWDLMDA20DUK and TWDLMDA20DTK Modular bases.





TWDLMDA40-DUK and TWDLMDA40-DTK Dimensions

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



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

How to Direct Mount a Modular Base on a Panel Surface

Introduction

This section shows how to install mounting strips directly on modular bases. This section also provides mounting hole layouts for modular bases. Your base may differ from the illustrations in these procedures but the basic mechanism procedures are applicable.

Installing a Mounting Strip

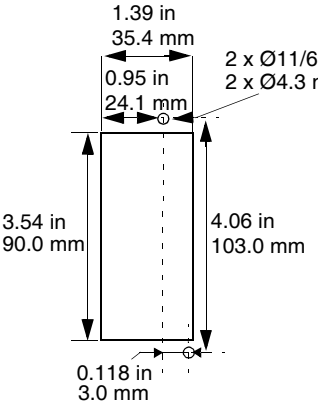
The following procedure shows how to install a mounting strip.

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.

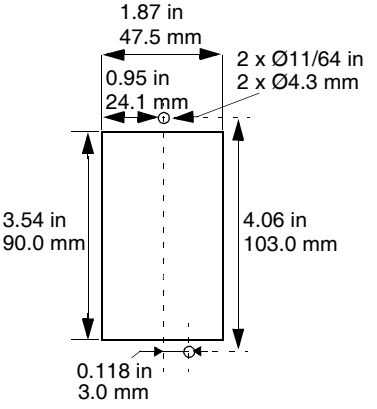
Mounting Hole Layout for Modular Bases

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

TWDLMDA20DUK
TWDLMDA20DTK



TWDLMDA20DRT
TWDLMDA40DUK
TWDLMDA40DUK



How to Install and Remove a Modular Base from a DIN Rail

Introduction

This section describes how to install and remove modular base 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.

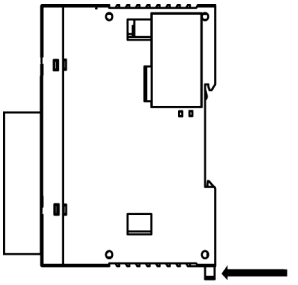
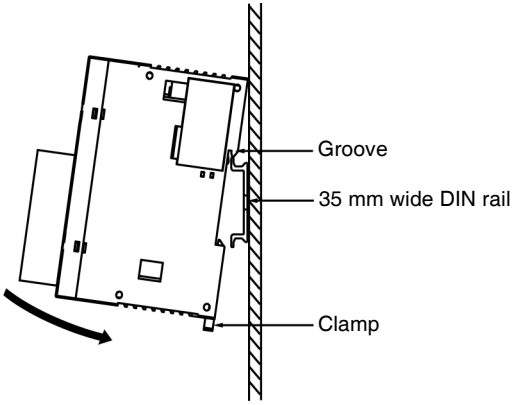
Note: When mounting modular bases on a DIN rail, use two end stops, type AB1-AB8P35 or equivalent.

For additional information about the DIN rail,

see The DIN Rail. *The DIN Rail, p. 229*

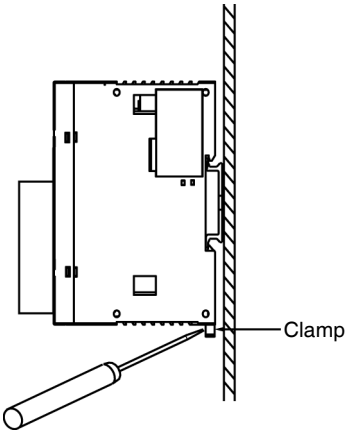
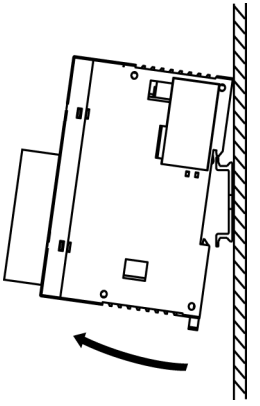
How to Install a Modular Base on a DIN Rail

The following procedure shows how to install a Modular base 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 modular base and module assembly. 
3	Put the top groove of the modular base 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 Modular Base from a DIN Rail

The following procedure shows how to remove a modular base 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 modular base and the associated module off the DIN rail from the bottom. 

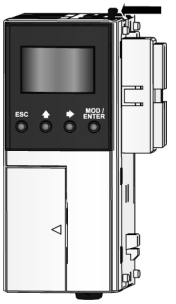
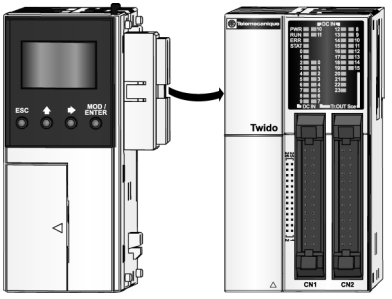
How to Install the Operator Display Expansion Module

Introduction

This section describes the TWDXCPODM installation and removal of the operator display expansion module .

Assembling the Operator Display Expansion Module to a Modular Base

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

Step	Action
1	Remove the communication connector cover on the left side of the Modular base.
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 base to the connector on the right side of the operator display expansion module. 
4	Press the operator display expansion module to the Modular base 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 base.

Disassembling an Operator Display Expansion Module from a Modular Base

To remove the TWDXCPODM operator display expansion module from a Modular base, see *Disassembling an Expansion I/O Module from a Base, p. 41*.

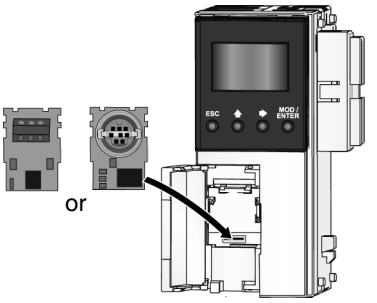
How to Install a Serial Interface Adapter to Modular Bases

Introduction

This section shows how to install the TWDNAC232D, TWDNAC485D or TWDNAC485T serial interface adapter in a TWDXCPODM operator display expansion module. Your base may differ from the illustrations in these procedures but the basic mechanism procedures are applicable.

How to Install a Serial interface Adapter in the Operator Display Expansion Module

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

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

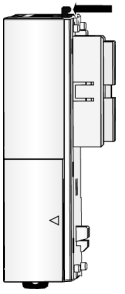
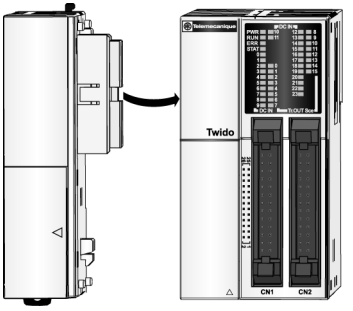
How to Install a Second Serial Interface Expansion Module to a Modular Base

Introduction

This section shows how to assemble the TWDNOZ232D, TWDNOZ485D, and TWDNOZ485T second serial interface expansion module to a Modular base. This section also shows how to install the TWDNOZOD232D, TWDNOZOD485D, andTWDNOZOD485T second serial interface expansion module with operator display to a Modular base. Your base may differ from the illustrations in these procedures but the basic mechanism procedures are applicable.

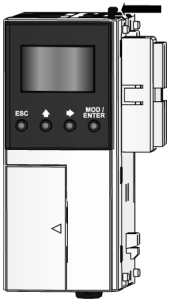
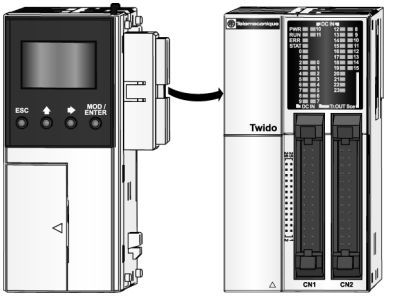
Assembling a Second Serial Interface Expansion Module to a Modular Base

The following procedure shows how to assemble the TWDNOZ485D, TWDNOZ232D, or TWDNOZ485T second serial interface expansion module to a Modular base.

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

Installing a Second Serial Interface Expansion Module with Operator Display

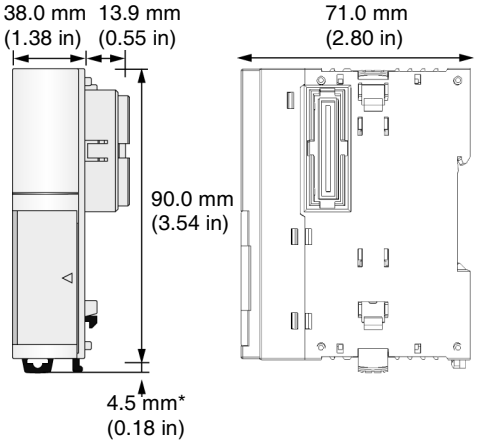
The following procedure shows how to assemble the TWDNOZO485D, TWDNOZO232D, or TWDNOZO485T second serial interface expansion module to a Modular base.

Step	Action
1	Remove the communication connector cover on the left side of the Modular base.
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 base to the connector on the right side of the operator display expansion module. 
4	Press the operator display expansion module to the Modular base 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 base.

Second Serial Interface Expansion Module Dimensions

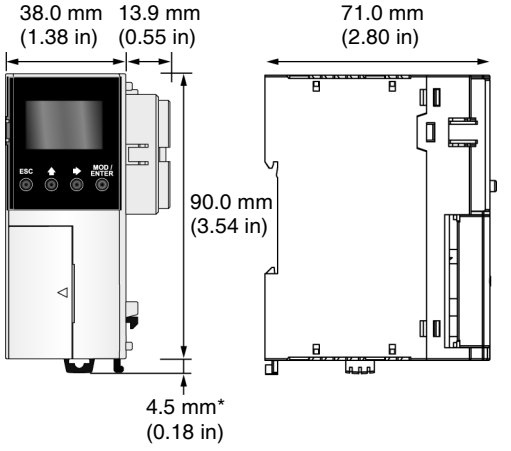
The following diagram shows the dimensions for all second serial interface expansion modules (TWDNOZ232D, TWDNOZ485T, and TWDNOZ485D).

Illustration of the TWDNOZ485T module:



Second Serial Interface Expansion Module with Operator Display Dimensions

The following diagram shows the dimensions for all second serial interface expansion modules with operator display (TWDNOZOD232D, TWDNOZOD485T, and TWDNOZOD485D).



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

Removing a Terminal Block

Introduction

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

Removing a Terminal Block

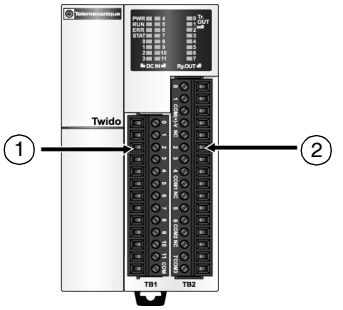
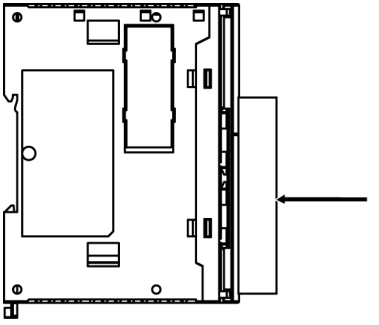
The following procedure shows how to remove a terminal block from the TWDLMDA20DRT Modular base.

⚠ 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.

Step	Action
1	Power off to the Modular base 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. 

How to Install a Memory or RTC Cartridge in a Modular Base

Introduction

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

Installing a Cartridge in a Modular Base

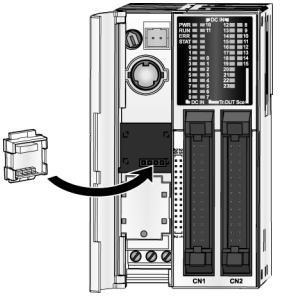
The following procedure shows how to install the TWDXCPMFK32 or TWDXCPMFK64 memory cartridge or the TWDXCPRTC RTC cartridge in a Modular base. Only one RTC cartridge can be installed. A memory cartridge and an RTC cartridge can be installed at the same time.

⚠ CAUTION

EQUIPMENT DAMAGE

When handling the cartridges, do not touch the pins. The cartridge 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 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 base connector until it "clicks". 
4	Close the hinged door.

How to Connect the Power Supply to Modular Bases

Introduction

This section describes how to connect the power supply to the Modular bases.

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

⚠ CAUTION

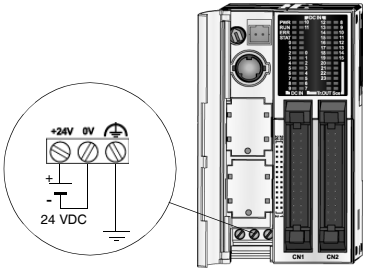
INCOMPATIBLE OR IMPROPER POWER SUPPLY CONNECTIONS

- 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 a Power Supply to a Modular Base

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



Modular Base Power Supply Specifications

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

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.

Description of Compact Bases

3

At a Glance

Introduction

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

What's in this Chapter?

This chapter contains the following sections:

3.1 Compact Bases Description

At a Glance

Introduction

This section provides an overview and a parts description of the Compact bases.

What's in this Section?

This section contains the following topics:

Overview of Compact Bases

Introduction

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

Compact Controllers Features Overview

The following table gives information about the main features of the different types of Compact controllers:

Features	**10 I/O bases: TWDLCAA10DRF TWDLCDA10DRF**	**16 I/O bases: TWDLCAA16DRF TWDLCDA16DRF**	**24 I/O bases: TWDLCAA24DRF TWDLCDA24DRF**	**40 I/O bases: TWDLCAA40DRF TWDLCDA40DRF**
Inputs	6 discrete inputs	9 discrete inputs	14 discrete inputs	24 discrete inputs
Outputs	4 relay outputs	7 relay outputs	10 relay outputs	14 relay and 2 transistor outputs
Analog Potentiometers	1	1	2	2
Integrated Serial Port	√	√	√	√
Additional Serial Port	No	one slot available	one slot available	one slot available
RTC cartridge (optional)	√	√	√	RTC onboard
Memory cartridge (optional)	32 KB	32 KB	32 KB	32 KB or 64 KB
Battery Compartment	No	No	No	√
Expansion I/O Modules	No	No	up to 4 modules	up to 7 modules
AS-I V2 bus Modules	No	No	up to 2 modules	up to 2 modules
CANopen fieldbus Module	No	No	√	√
Operator Display Module (optional)	√	√	√	√
Ethernet interface	1 ConneXium TwidoPort module	1 ConneXium TwidoPort module	1 ConneXium TwidoPort module	For TWDLCAA40DRF: 1 ConneXium TwidoPort module For TWDLCAE40DRF: 1 Built-in RJ-45 port

Illustration of Compact 10 I/O Controllers

The following illustration gives a picture of the two types of 10 I/O Compact controllers:

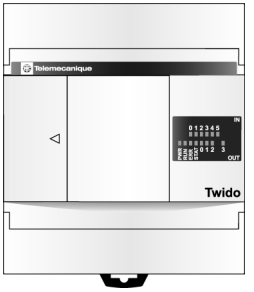
Controller References	Illustration
TWDLCAA10DRF TWDLCDA10DRF Note: Power supply: ● 100/240 VAC for theTWDLCAA10DRF ● 24 VDC for theTWDLCDA10DRF	TWDLCAA10DRF TWDLCDA10DRF 

Illustration of Compact 16I/O Controllers

The following illustration gives a picture of the two types of 16 I/O Compact controllers:

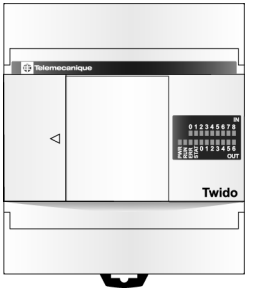
Controller References	Illustration
TWDLCAA16DRF TWDLCDA16DRF Note: Power supply: ● 100/240 VAC for theTWDLCAA16DRF ● 24 VDC for theTWDLCDA16DRF	TWDLCAA16DRF TWDLCDA16DRF 

Illustration of Compact 24 I/O Controllers

The following illustration gives a picture of the two types of 24 I/O Compact controllers:

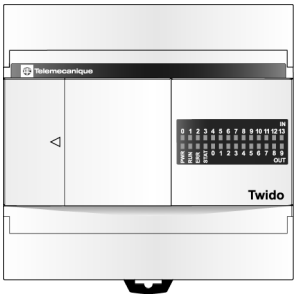
Controller References	Illustration
TWDLCAA24DRF TWDLCDA24DRF Note: Power supply: ● 100/240 VAC for theTWDLCAA24DRF ● 24 VDC for theTWDLCDA24DRF	TWDLCAA24DRF TWDLCDA24DRF 

Illustration of Compact 40 I/O Controllers

The following illustration gives a picture of the two types of 40 I/O Compact controllers:

Controller References	Illustration
TWDLCAA40DRF TWDLCDA40DRF Note: Power supply: ● 100/240 VAC for theTWDLCAA40DRF ● 24 VDC for theTWDLCDA40DRF	TWDLCAA40DRF  TWDLCAE40DRF 

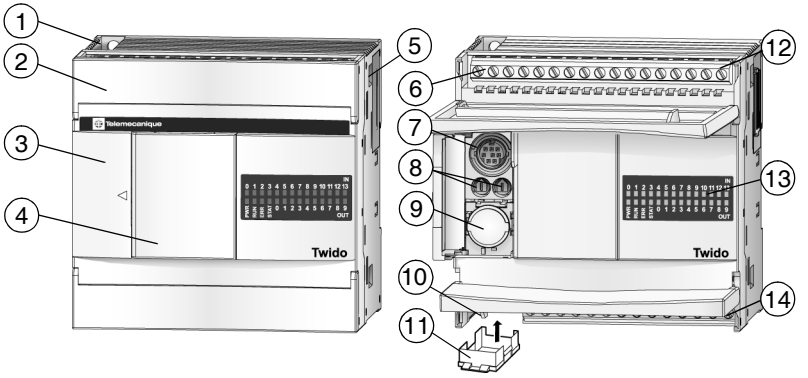
Parts Description of a Compact Base

Introduction

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

Parts Description of a Compact Base

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

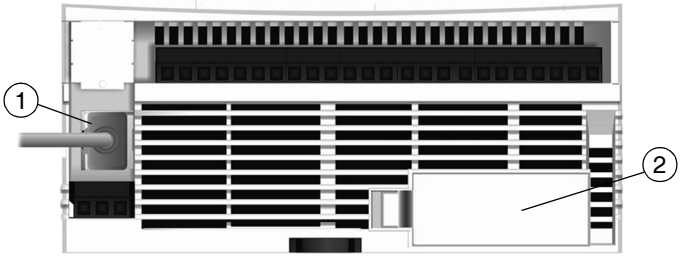


Caption

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 any
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 base
12	Input terminals
13	LEDs
14	Output terminals

Rear Panel of a 40DRF Compact Base

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



Caption

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)

3.2 Specifications for Compact Bases

At a Glance

Introduction

This section provides general, electrical, I/O, and functional specifications, and Analog Potentiometers description for Compact bases.

What's in this Section?

This section contains the following topics:

General Specifications for the Compact Bases

Introduction

This section provides general specifications for the Compact bases.

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, serious injury, or equipment damage.

Normal Operating Specifications

Compact base 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 bases 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 package.

Electrical Specifications for the Compact Bases

Introduction

This section provides electrical specifications for the Compact bases.

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, serious injury, or equipment damage.

Electrical Specifications

Compact base 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 base power consumption includes 250 mA sensor power.	31 VA (264 VAC), 22 VA (100 VAC) This base power consumption includes 250 mA sensor power.	40 VA (264 VAC), 33 VA (100 VAC) This base plus 4 I/O modules power consumption includes 250 mA sensor power.	77 VA (264 VAC), 65 VA (100 VAC) This base 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 base TWDLC...	**DA10DRF**	**DA16DRF**	**DA24DRF**
Rated power voltage	24 VDC		
Allowable voltage range	from 19.2 to 30 VDC (including ripple)		
Maximum input power	Base	Base	Base 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		

Input Specifications for the Compact Base

Introduction

This section provides Input specifications for the Compact bases.

DC Input Specifications

⚠ WARNING

HAZARDS OF UNINTENDED EQUIPMENT OPERATION & EQUIPMENT DAMAGE

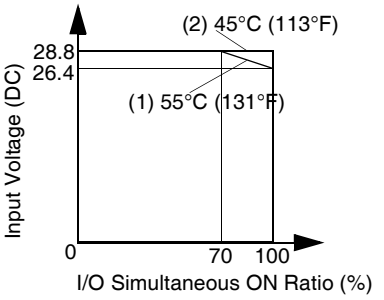
Do not exceed any of the rated values specified below.

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

Compact base	**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)			
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.			

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 bases 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 base, 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 *Compact and Modular Bases Mounting Positions, p. 37*.

Relay Output Specifications for the Compact Base

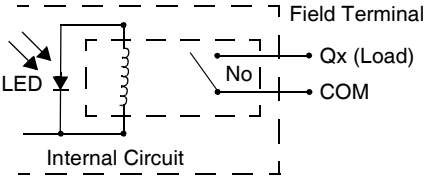
Introduction This section provides relay output specifications for the Compact bases.

Relay Output Specifications

Compact base	**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			

Relay Output Contact

The relay output contact is shown below.



Output Transistor Specifications for the Compact Base

Introduction

This section provides Output transistor specifications for the Compact bases.

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.

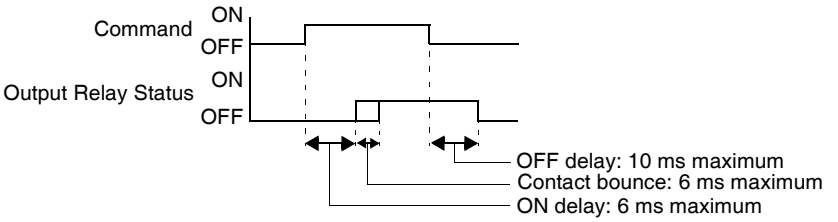
Failure to follow this instruction can result in injury or equipment damage.

Transistor Source Output Specifications

Compact base	**TWDLCAA40DRF and TWDLCAE40DRF**
Output type	Source output
Number of discrete 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 ($I \geq 5mA$)

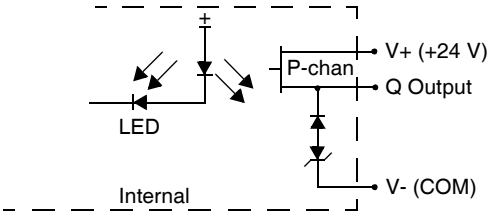
Output delay

The output delay is shown below.



Transistor Source Output Contact

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



Description of Analog Potentiometers

Introduction

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

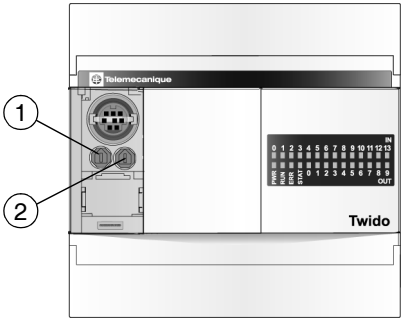
Description

The TWDLC•A10DRF[1] and TWDLC•A16DRF[1] bases have one analog potentiometer. The TWDLC•A24DRF[1] and TWDLCA•40DRF[2] bases 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 TwidoSuite 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 Base

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



Caption

Label	Description
1	Analog potentiometer 1
2	Analog potentiometer 2

Functional Specifications for the Compact Bases

Introduction This section provides functional specifications for the Compact bases.

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 base 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 base
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 bases.
	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 bases: - 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".**		

3.3 Wiring Rules and Recommendations, and Wiring Schematics for Compact Bases

At a Glance

Introduction

This section provides wiring rules and recommendations, and wiring schematics for Compact bases.

What's in this Section?

This section contains the following topics:

Wiring Rules and Recommendations for Compact Bases

Introduction

There are several rules that must be followed when wiring a compact base. 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 or serious injury.

⚠ WARNING

FAILURE OF OUTPUTS

Use appropriate safety interlocks where personal and/or equipment hazards exist. Outputs can fail and remain ON or OFF.

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.
- 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.
- Make sure that the operating conditions and environments are within the specification values.
- Use proper wire size to meet voltage and current requirements.

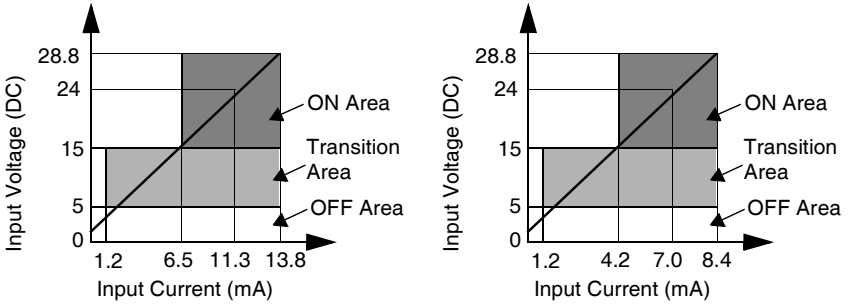
Terminal Tightening Torque

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

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.

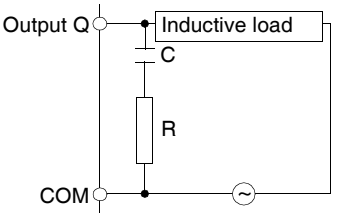
Latching or High Speed Sink or Source Inputs **Standard Sink or Source Input**

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

Contact Protection Circuit for Relay and Transistor Outputs

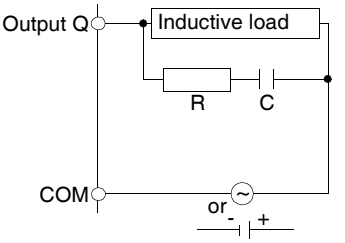
Depending on the load, a protection circuit may be needed for the relay output on the bases. Choose a protection circuit, from the following diagrams, according to the power supply. Connect the protection circuit to the outside of the base or relay output module.

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.



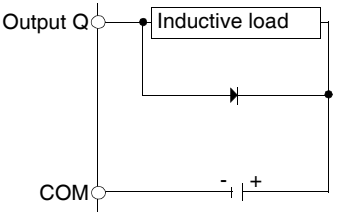
- C represents a value from 0.1 to 1 μF.
- R represents a resistor of approximately the same resistance value as the load.

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.

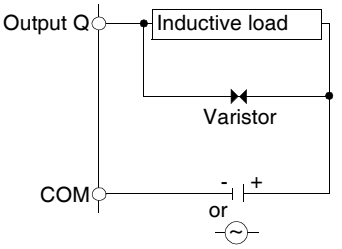
Protective circuit C: this protection circuit can be used for DC load power circuits.



Use a diode with the following ratings:

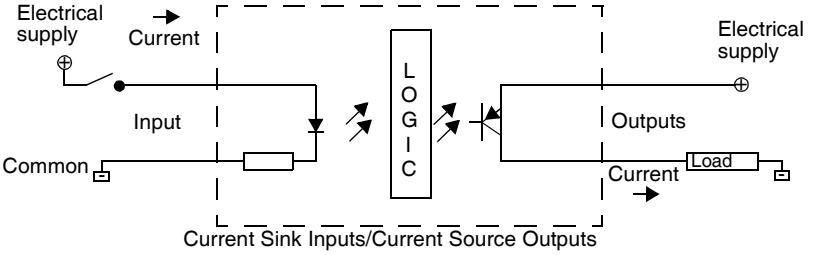
- Reverse withstand voltage: power voltage of the load circuit x 10.
- Forward current: more than the load current.

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



Explanation of Source Inputs/ Sink Outputs

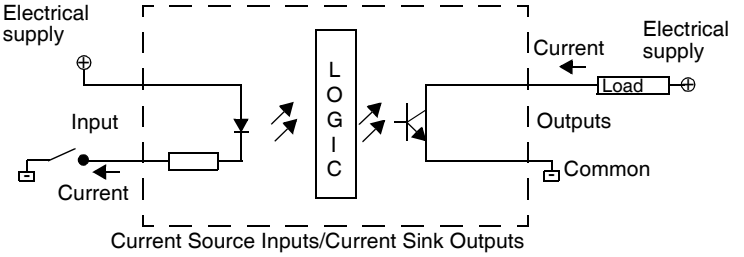
Note: Sink corresponds to the sensors' common on the (+) terminal of the power supply.



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.

Compact Base Wiring Schematics

Introduction

This section shows examples of wiring schematics for Compact bases. Symbols used in the following diagrams are explained in the glossary of symbols (See *Glossary of Symbols, p. 231*) in the appendix.

⚠ 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 or serious injury.

⚠ 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.

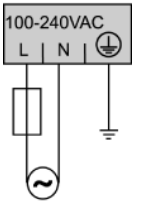
Failure to follow this instruction can result in injury or equipment damage.

Note: These schematics are for external wiring only.

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

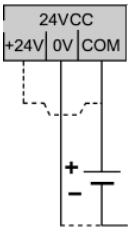
AC Power Supply Wiring Schematic

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



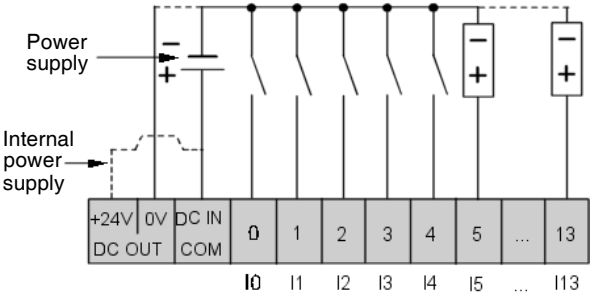
DC Power Supply Wiring Schematic

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

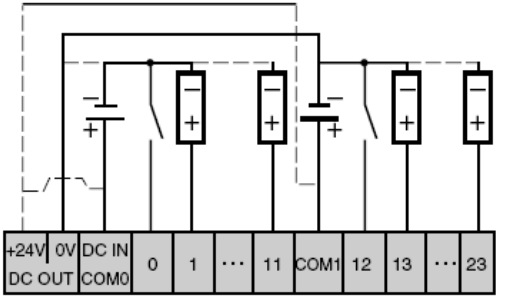


DC Source Input Wiring Schematic

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

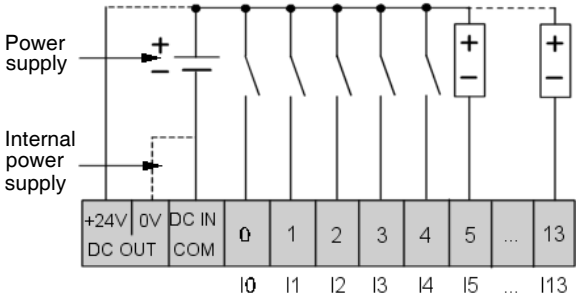


The following DC source input wiring schematic is for the TWDLCA•40DRF series bases.

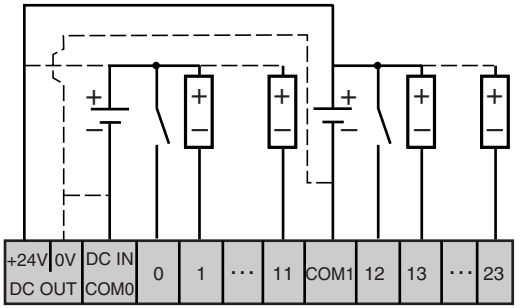


DC Sink Input Wiring Schematic

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

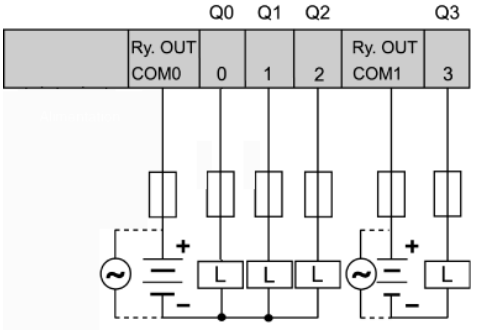


The following DC sink input wiring schematic is for the TWDLCA•40DRF series controllers.

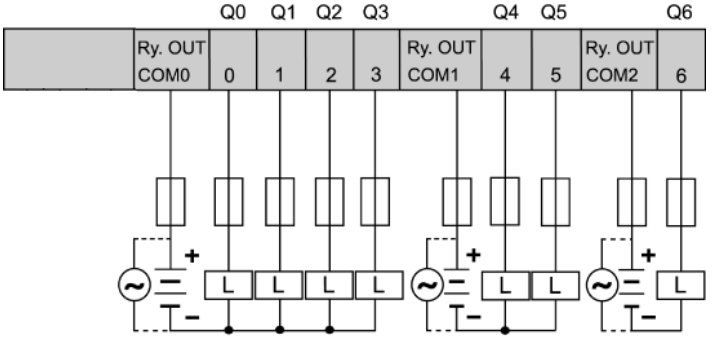


Relay and Transistor Output Wiring Schematic

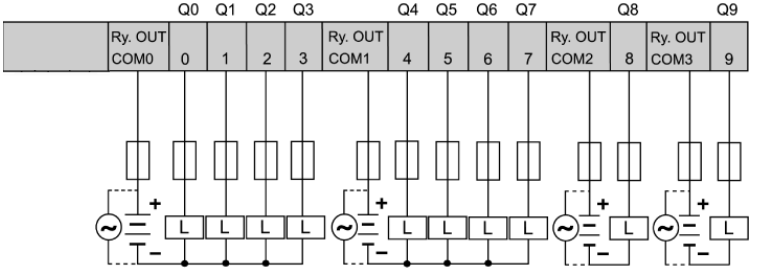
This schematic is for the TWDLC•A10DRF series bases.



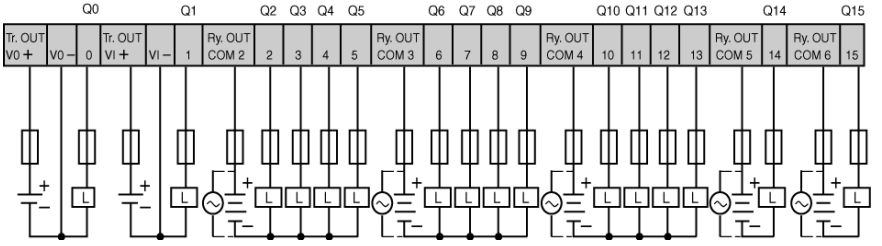
This schematic is for the TWDLC•A16DRF series bases.



This schematic is for the TWDLC•A24DRF series bases.



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



Reverse-Polarity at Transistor Output is Not Allowed

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

3.4 Compact Bases Options

At a Glance

Introduction

This section provides information about memory cartridges, RTC cartridges, operator display modules and input simulators as options for Compact bases.

What's in this Section?

This section contains the following topics:

Memory Cartridges

Introduction

The following section provides an overview and specifications about the TWDXCPMFK32 and TWDXCPMFK64 memory cartridges, as options for the Compact bases.

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 compact base if certain conditions exist.
- Increase the program memory capacity.

The following table presents the available memory cartridge for each compact base.

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

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

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 base
Software for storing data	TwidoSuite
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 (RTC) Cartridge

Introduction

This section provides an overview and specifications for the TWDXCPRTC RTC cartridge, as an option for Compact bases.

Overview of the Real Time Clock (RTC) Cartridge

An optional Real Time Clock cartridge (TWDXCPRTC) is available for all compact bases. (Note that 40 I/O compact bases have RTC onboard)

The Real Time Clock cartridge provides the compact base with the current time and date.

The RTC is required for the Schedule Blocks to operate.

When the compact base 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.

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

Operator Display Modules

Introduction

The following section provides an overview of the TWDXCPODC operator display module. This section also describes the parts, specifications and dimensions of the TWDXCPODC operator display module

Overview

The operator display is an optional module that can be added to any of the compact bases. It is installed into a Compact base as an operator display module (TWDXCPODC). See *How to Install the Operator Display Module, p. 51*.

The operator display provides the following services:

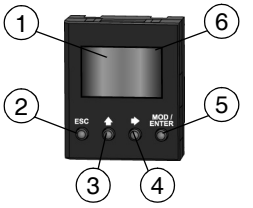
- Displays the controller state information
- Allows the user to control the base
- Allows the user to monitor and tune application data objects

The operator display has two states:

- Display state - Displays data
- Edit state - Allows the user to change data

Parts Description of an Operator Display Module

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

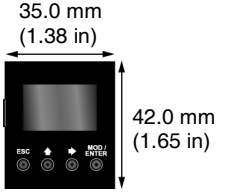


Caption

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 base.

Operator Display Module Dimensions

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



Operator Display Module Specifications

The following table describes the operator display module specifications.

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

Input Simulators

Introduction

The following section provides an overview of the TWDXSM6, TWDXSM9, and TWDXSM14 input simulators for compact bases.

Overview of the Input Simulators

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

Description of Modular Bases

4

At a Glance

Introduction

This chapter provides overviews, parts descriptions, specifications, wiring rules and recommendations, wiring schematics, and options for the Modular bases.

What's in this Chapter?

This chapter contains the following sections:

4.1 Modular Bases Description

At a Glance

Introduction

This section provides an overview and a parts description of the Modular bases.

What's in this Section?

This section contains the following topics:

Overview of Modular Controllers

Introduction

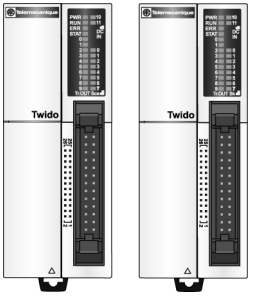
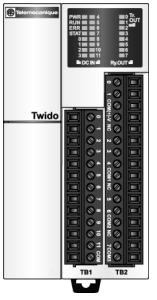
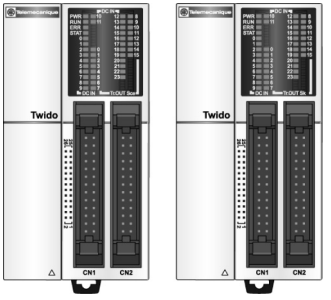
The information in this section describes the main features of the Modular bases.

Modular Bases Features Overview

The following table gives information about the main features of the different types of Modular bases:

Features	20 I/O bases: TWDLMDA20DTK TWDLMDA20DUK	20 I/O bases: TWDLMDA20DRT	40 I/O bases: TWDLMDA40DTK TWDLMDA40DUK
Inputs	12 discrete inputs	12 discrete inputs	24 discrete inputs
Outputs	8 transistor source outputs: TWDLMDA20DTK 8 transistor sink outputs: TWDLMDA20DUK	6 relay outputs + 2 transistor source outputs	16 transistor source outputs: TWDLMDA40DTK 16 transistor sink outputs: TWDLMDA40DUK
Analog Voltage Input Connector	1	1	1
Analog Potentiometers	1	1	1
Integrated Serial Port	√	√	√
Wiring	Connector	Terminal Block	Connector
RTC cartridge (optional)	√	√	√
Memory cartridge (optional)	32 KB / 64 KB	32 KB / 64 KB	32 KB / 64 KB
Expansion I/O Modules	up to 4 modules	up to 7 modules	up to 7 modules
AS-I V2 bus Modules	up to 2 modules	up to 2 modules	up to 2 modules
CANopen fieldbus Module	√	√	√
Operator Display Expansion Module (optional)	√	√	√
Communication Expansion Module (optional)	√	√	√
Ethernet interface	1 ConneXium TwidoPort module	1 ConneXium TwidoPort module	1 ConneXium TwidoPort module

Illustrations The following illustrations are the Modular bases:

Illustration
TWDLMDA20DTK TWDLMDA20DUK 
TWDLMDA20DRT 
TWDLMDA40DTK TWDLMDA40DUK 

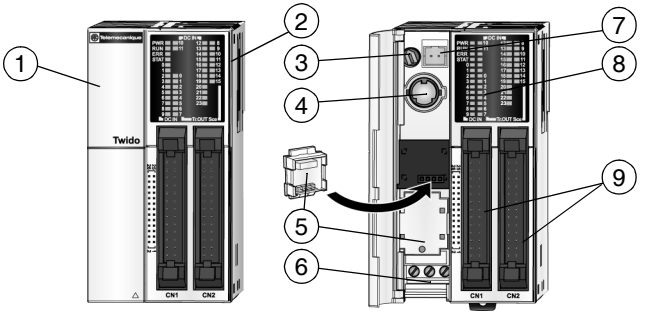
Parts Description of a Modular Base

Introduction

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

Parts Description of a Modular Base

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



Caption

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

4.2 Modular Bases Specifications

At a Glance

Introduction

This section provides general specifications, electrical specifications, inputs and outputs specifications, analog potentiometers description, analog voltage input overview, and functional specifications for Modular bases.

What's in this Section?

This section contains the following topics:

General Specifications for the Modular Bases

Introduction

This section provides general specifications for the Modular bases.

Normal Operating Specifications

Modular base	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 for the Modular Bases

Introduction

This section provides electrical specifications for the Modular bases.

Electrical Specifications

Modular base	**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	Base plus 4 I/O Modules	Base 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		

Input Specifications for the Modular Bases

Introduction

This section provides Input specifications for the Modular bases.

DC Input Specifications

⚠ WARNING

HAZARDS OF UNINTENDED EQUIPMENT OPERATION & EQUIPMENT DAMAGE

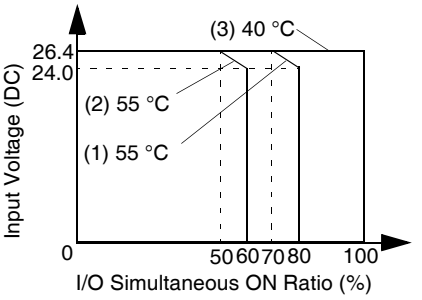
If any input exceeding the rated value is applied, permanent damage may be caused.

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

Modular base	**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.		
Cable length	3m (9.84 ft) for compliance with electromagnetic immunity		
Connector insertion/removal durability	100 times minimum		

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	Sink	Source	Source	Source
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/ off time	Q0, Q1: 5 µs maximum Q2 to Q15: 300 µs maximum				

Relay Output Specifications

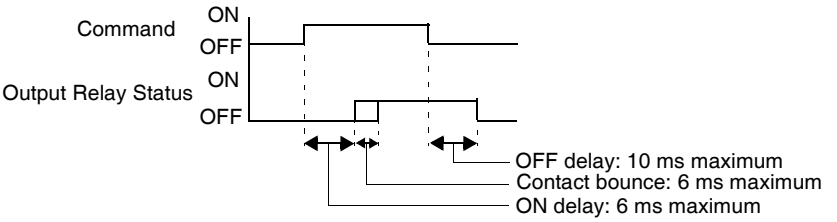
Modular controller	TWDLMDA20DRT
Number of outputs	8 discrete inputs consisting of 6 relay outputs and 2 transistor source outputs
Output points per common line - COM0	2 outputs
Output points per common line - COM1	3 NO contacts
Output points per common line - COM2	2 NO contacts
Output points per common 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.

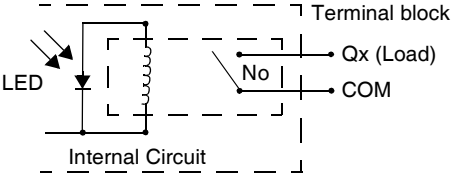
Output delay

The output delay is shown below.



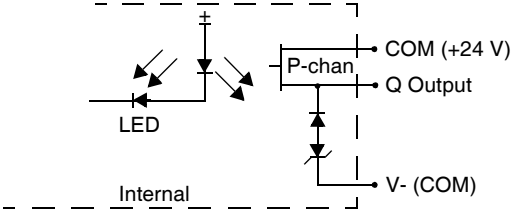
Relay Output Contact

The relay output contact is shown below.



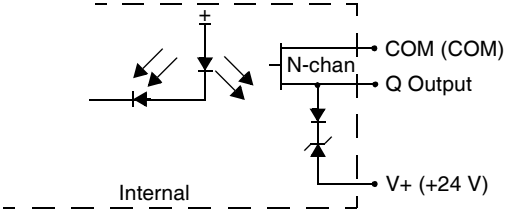
Transistor Source Output Contact

The transistor source output contact is shown below.



Transistor Sink Output Contact

The transistor sink output contact is shown below.



Relay Output Specifications for the Modular Bases

Introduction This section provides Relay output specifications for the Modular bases.

Relay Output Specifications

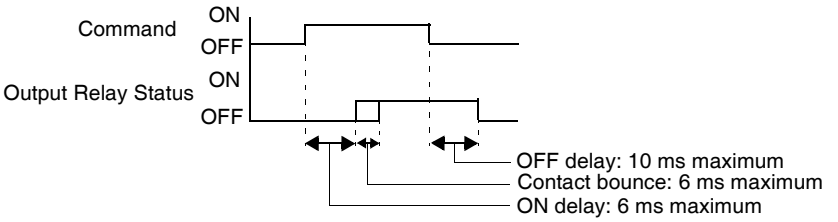
Modular base	TWDLMDA20DRT
Number of outputs	8 discrete inputs consisting of 6 relay outputs and 2 transistor source outputs
Output points per common line - COM0	2 outputs
Output points per common line - COM1	3 NO contacts
Output points per common line - COM2	2 NO contacts
Output points per common line - 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 TwidoSuite (2A) into account.

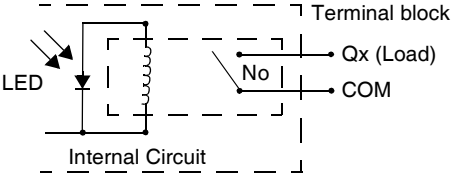
Output delay

The output delay is shown below.



Relay Output Contact

The relay output contact is shown below.



Transistor Outout Specifications for the Modular bases

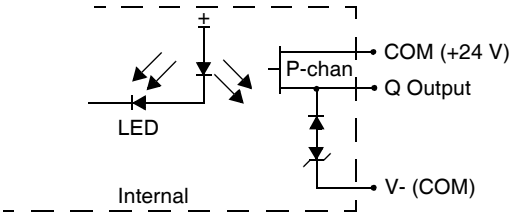
Introduction This section provides Transistor output specifications for the Modular bases.

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				

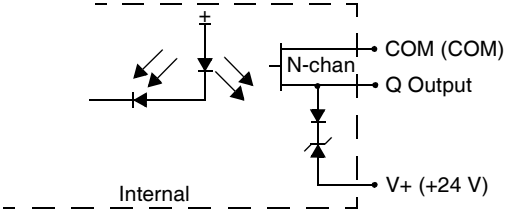
Transistor Source Output Contact

The transistor source output contact is shown below.



Transistor Sink Output Contact

The transistor sink output contact is shown below.



Description of Analog Potentiometers

Introduction

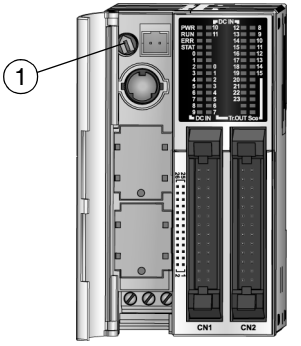
The following section describes the analog potentiometer on the Modular bases.

Description

The TWDLMDA20DUK, TWDLMADA20DTK, TWDLMDA20DRT, TWDLMDA40DUK, and TWDLMADA40DTK bases have one analog potentiometer. The analog potentiometer can be set to a value between 0 and 1023. The value is stored in a system words and is updated in every scan. For more information on setting the analog potentiometer, see the TwidoSuite Software Reference Manual.

Analog Potentiometer on a Modular Base

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



Caption

Label	Description
1	Analog potentiometer 1

Overview of Analog Voltage Input

Introduction

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

Description

All Modular bases 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 511 and is stored in a system word.

Functional Specifications for the Modular Bases

Introduction This section provides functional specifications for the Modular bases.

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 steps)
	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"**		

4.3 Modular Bases Wiring

At a Glance

Introduction

This section provides wiring rules and recommendations, and wiring schematics for Modular bases.

What's in this Section?

This section contains the following topics:

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 or serious injury.

⚠ WARNING

FAILURE OF OUTPUTS

Use appropriate safety interlocks where personal and/or equipment hazards exist. Outputs can fail and remain ON or OFF.

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.

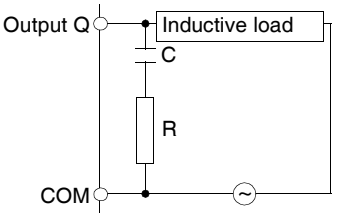
Terminal Tightening Torque

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

Contact Protection Circuit for Relay and Transistor Outputs

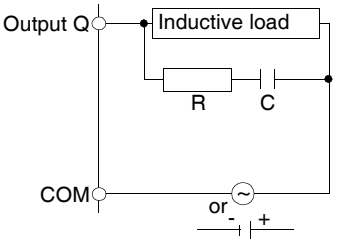
Depending on the load, a protection circuit may be needed for the relay output on the controllers and certain modules. Choose a protection circuit, from the following diagrams, according to the power supply. Connect the protection circuit to the outside of the controller or relay output module.

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.



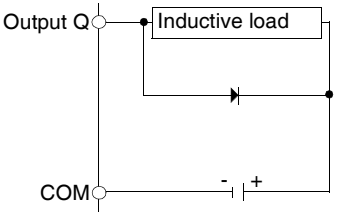
- C represents a value from 0.1 to 1 μF.
- R represents a resistor of approximately the same resistance value as the load.

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.

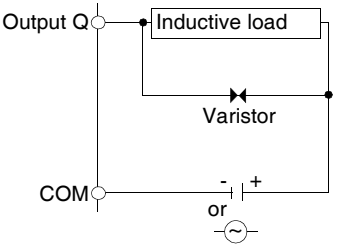
Protective circuit C: this protection circuit can be used for DC load power circuits.



Use a diode with the following ratings:

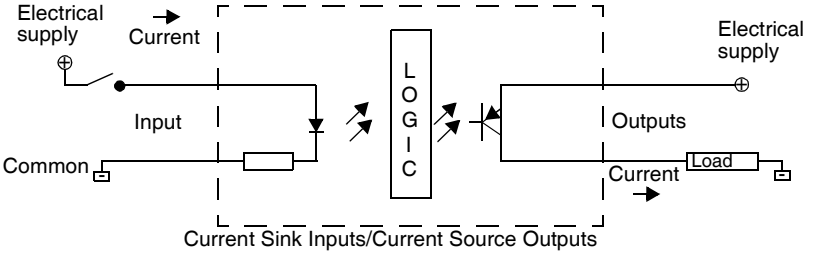
- Reverse withstand voltage: power voltage of the load circuit x 10.
- Forward current: more than the load current.

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



Explanation of Source Inputs/ Sink Outputs

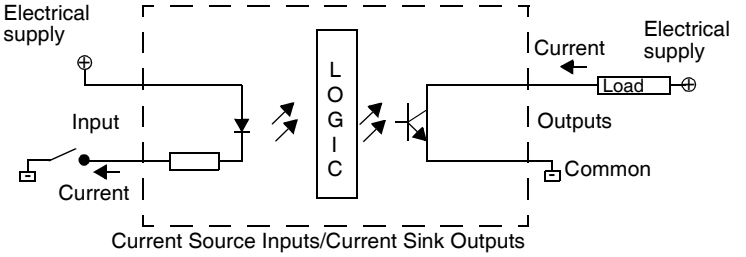
Note: Sink corresponds to the sensors' common on the (+) terminal of the power supply.



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.



Current Source Inputs/Current Sink Outputs

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.

Modular Base Wiring Schematics

Introduction

This section shows examples of wiring schematics for the Modular bases. Symbols used in the following diagrams are explained in the glossary of symbols (See *Glossary of Symbols, p. 231*) in the appendix.

⚠ 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.

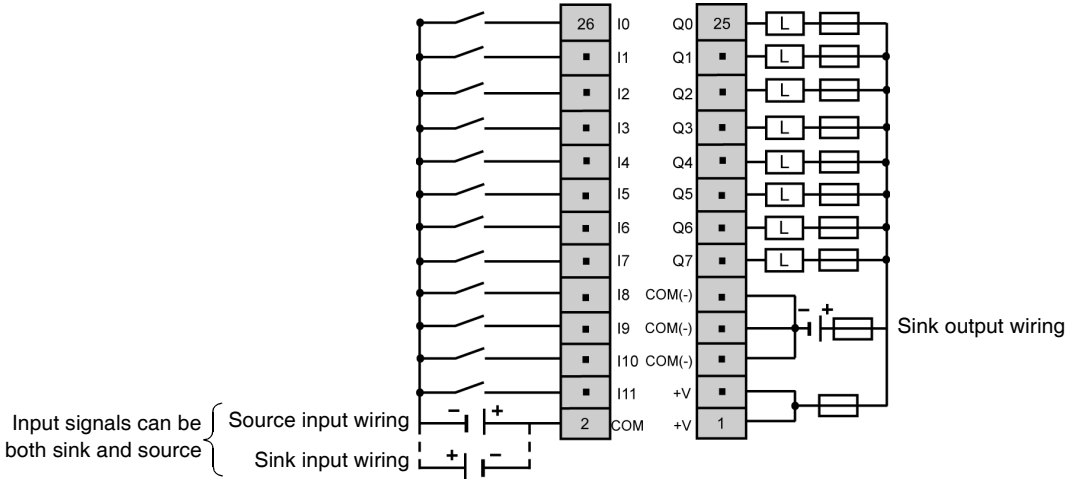
Failure to follow this instruction will result in death or serious injury.

Note: These schematics are for external wiring only.

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

TWDLMDA20-DUK Wiring Schematic

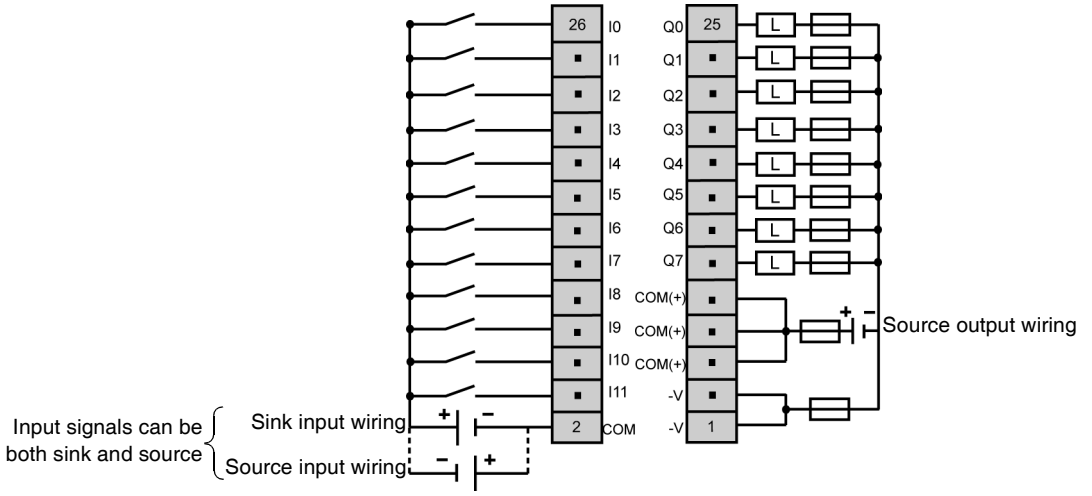
This schematic is for the TWDLMDA20DUK base with connector.



- 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

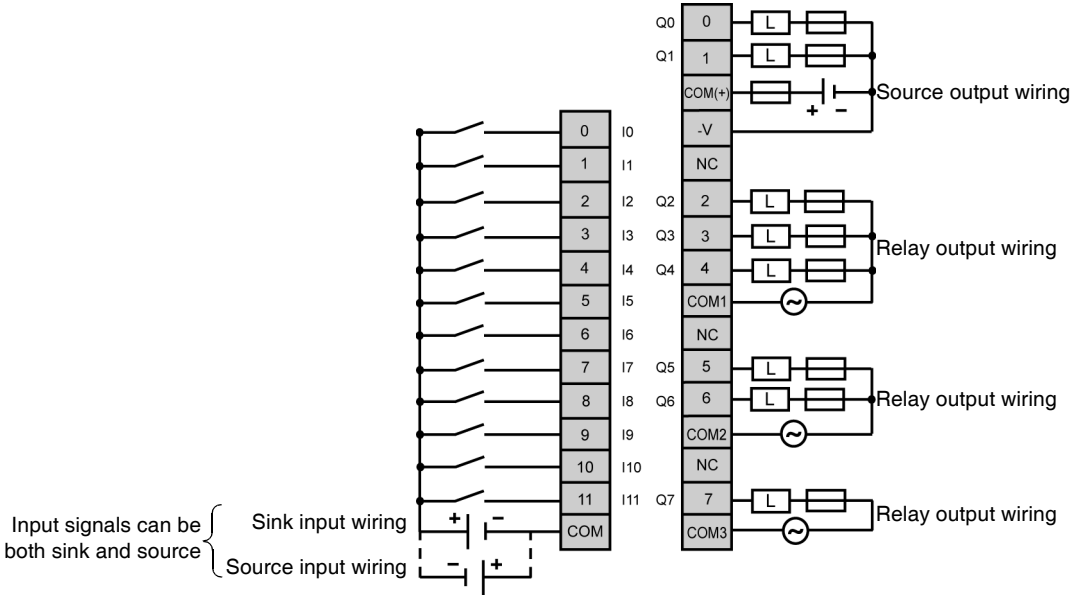
This schematic is for the TWDLMDA20DTK base with connector.



- 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

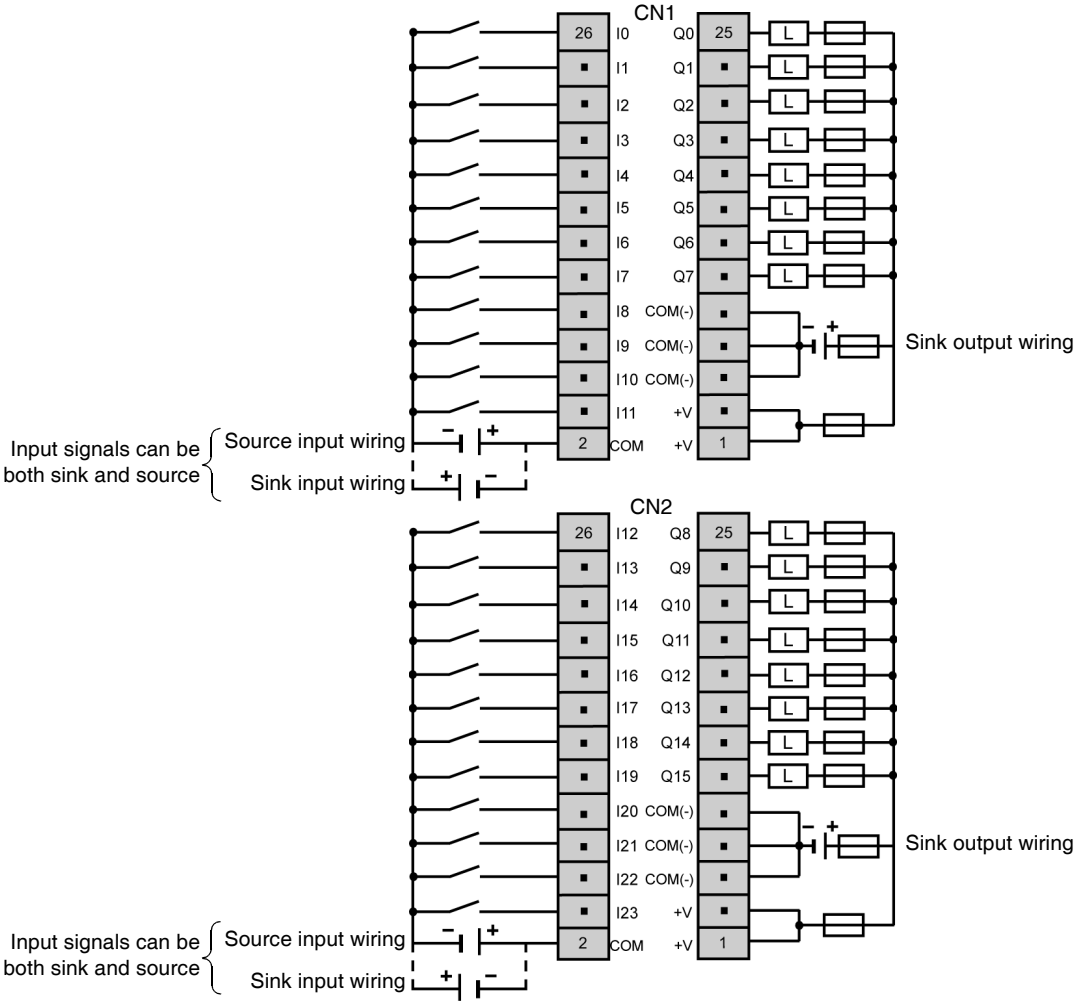
This schematic is for the TWDLMDA20DRT base with terminal block.



- 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

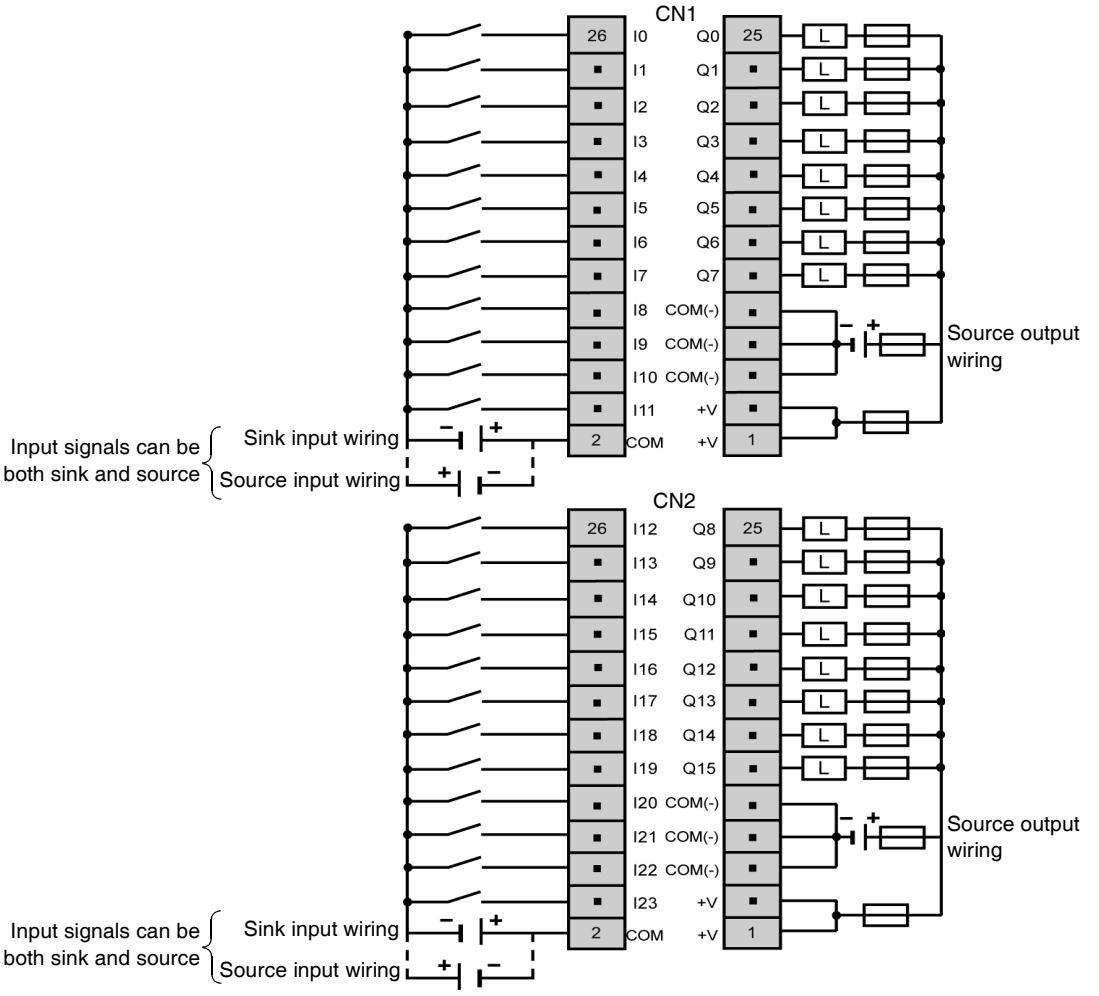
This schematic is for the TWDLMDA40DUK base with connector.



- 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 base 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.

4.4 Modular Bases Options

At a Glance

Introduction

This section provides information about memory cartridges, RTC cartridges, and operator display modules for Modular bases.

What's in this Section?

This section contains the following topics:

Memory Cartridges

Introduction

The following section provides an overview and specifications about the TWDXCPMFK32 and TWDXCPMFK64 memory cartridges, as options for the Modular bases.

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 modular base if certain conditions exist.
- Increase the program memory capacity.

The following table presents the available memory cartridge for each type of modular base.

Memory Cartridge	20 I/O modular	40 I/O modular
TWDXCPMFK32	yes	yes
TWDXCPMFK64	yes	yes

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

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 base
Software for storing data	TwidoSuite
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 (RTC) Cartridge

Introduction

This section provides an overview and specifications for the TWDXCPRTC RTC cartridge, as an option for Modular bases.

Overview of the Real Time Clock (RTC) Cartridge

An optional Real Time Clock cartridge (TWDXCPRTC) is available for all types of modular bases.

The Real Time Clock cartridge provides the Modular base with the current time and date. The RTC is required for the Schedule Blocks to operate.

When the Modular base 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.

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

Operator Display Expansion Modules

Introduction

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

Overview

The operator display is an optional module that can be added to any of the modular bases. It is assembled to a Modular base using the operator display expansion module (TWDXCPODM). See *How to Install the Operator Display Module, p. 51*.

The operator display provides the following services:

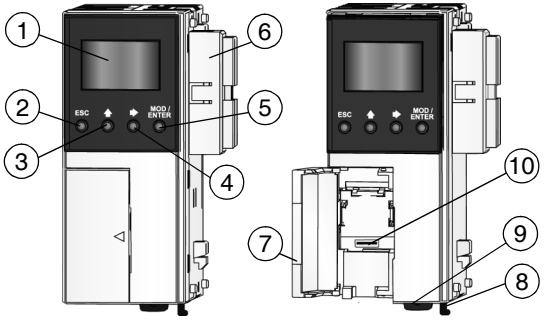
- Displays the base state information
- Allows the user to control the base
- Allows the user to monitor and tune application data objects

The operator display has two states:

- Display state - Displays data
- Edit state - Allows the user to change data

Parts Description of an Operator Display Expansion Module

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



Caption

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 base.
7	Hinged door	Opens to access the serial port 2.
8	Latch button	Holds/releases the module from a base.
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.

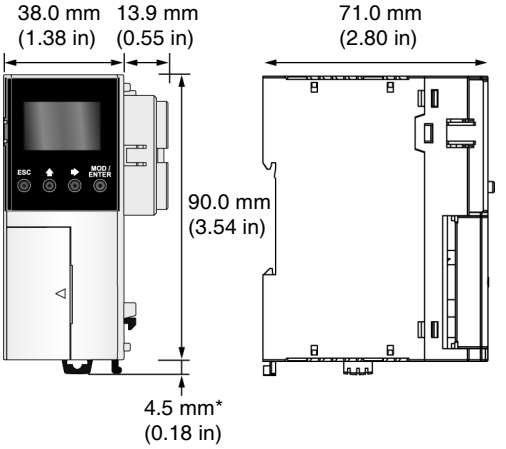
Operator Display Expansion Module Specifications

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

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.

Telefast® Pre-Wired Systems for Twido

5

At a Glance

Introduction

This chapter provides an overview of the Telefast® pre-wired system for Twido, Telefast® bases specifications, dimensions, and wiring schematics.

What's in this Chapter?

This chapter contains the following topics:

Overview of the Telefast® Pre-Wired System for Twido

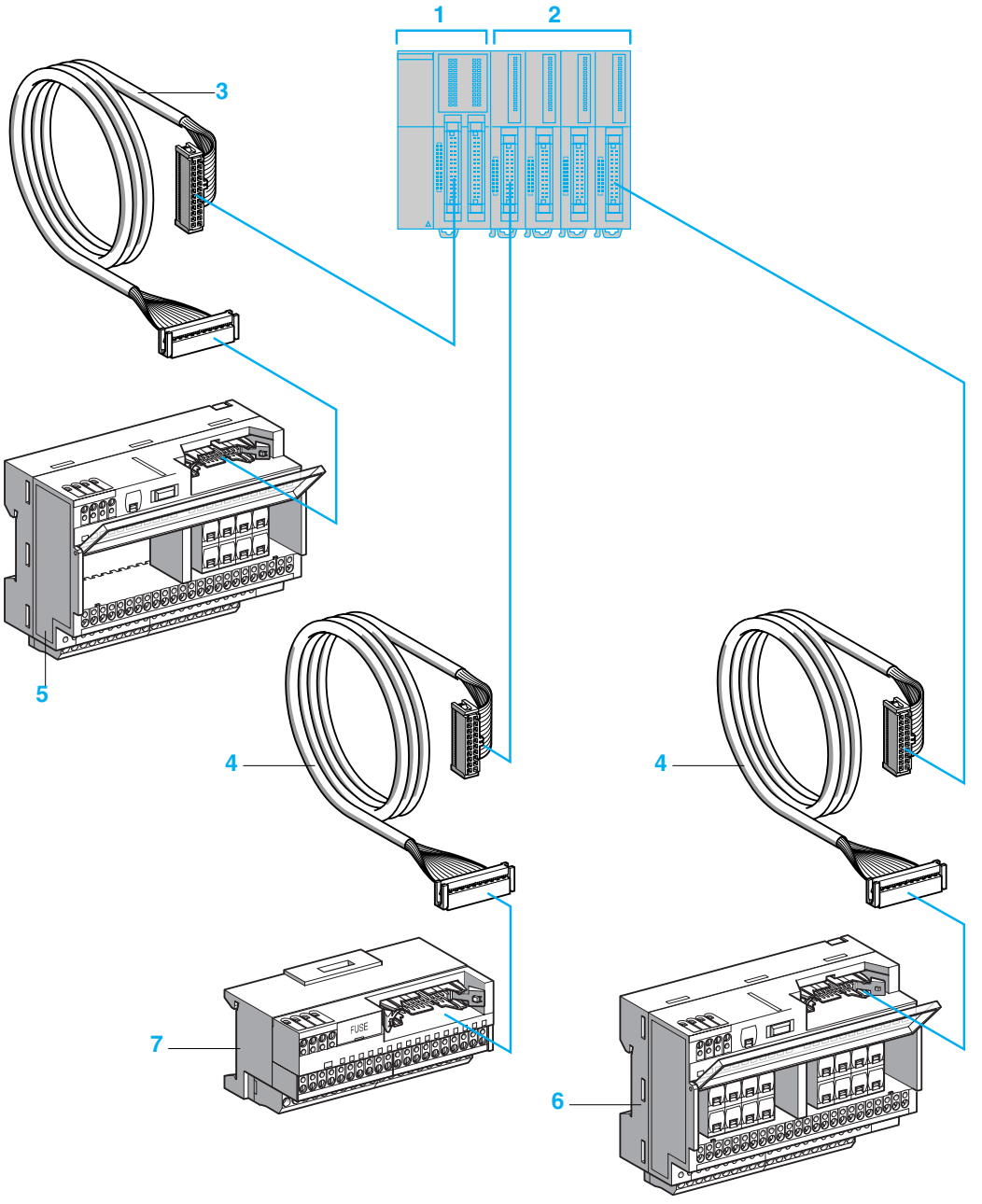
Introduction

The following section provides an overview of the

- ABE 7B20MPN20,
- ABE 7B20MPN22,
- ABE 7B20MRM20,
- ABE 7E16EPN20,
- ABE 7E16SPN20,
- ABE 7E16SPN22,
- ABE 7E16SRM20 Telefast® pre-wired systems for Twido.

Illustration

The following illustration shows the Telefast® system for Twido:



Caption

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

Dimensions of the Telefast® Bases

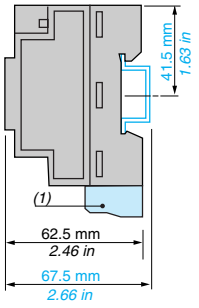
Introduction

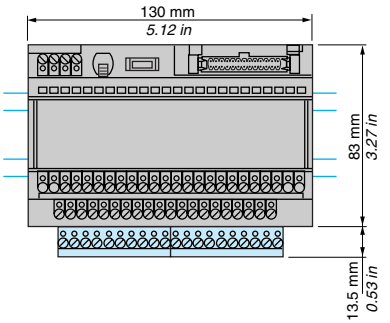
The following section shows the dimensions for the Telefast® bases.

ABE7B20MPN20 ABE7B20MPN22 ABE7B20MRM20 ABE7E16SPN22 ABE7E16SRM20

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

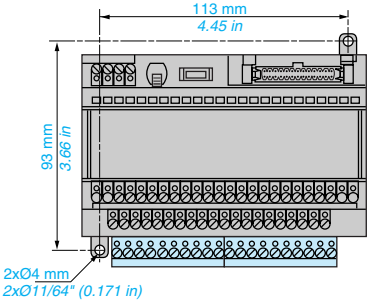
Mounting on 35 mm ⊓ rail





(1) ABE 7BV20, ABE 7BV20TB

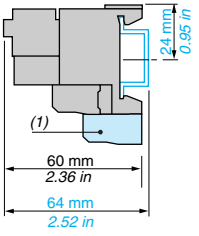
Screw fixing (retractable lugs)

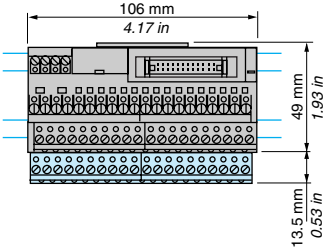


ABE7E16EPN20 ABE7E16SPN20

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

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 digital 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 digital 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

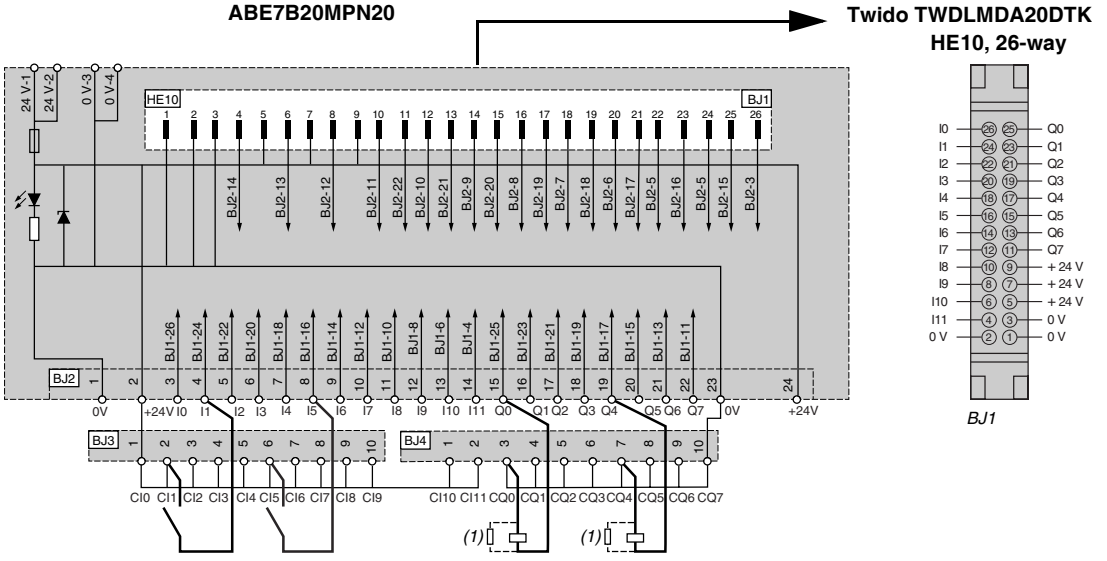
Introduction

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.**

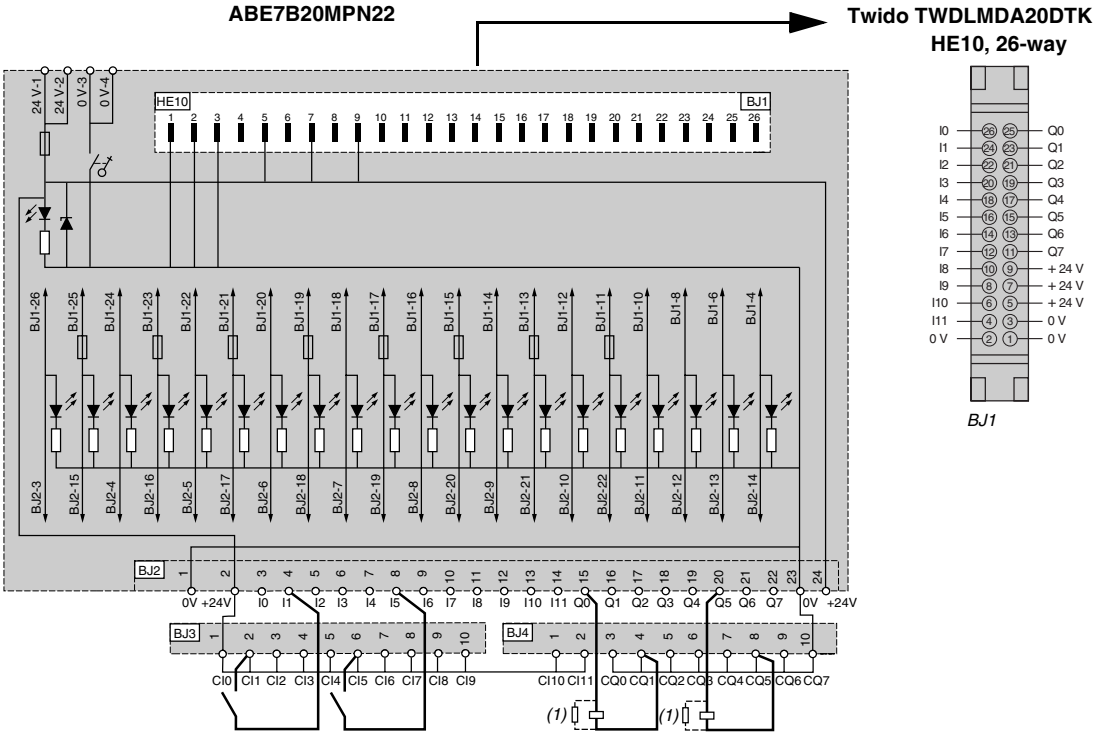
ABE7B20MPN20

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



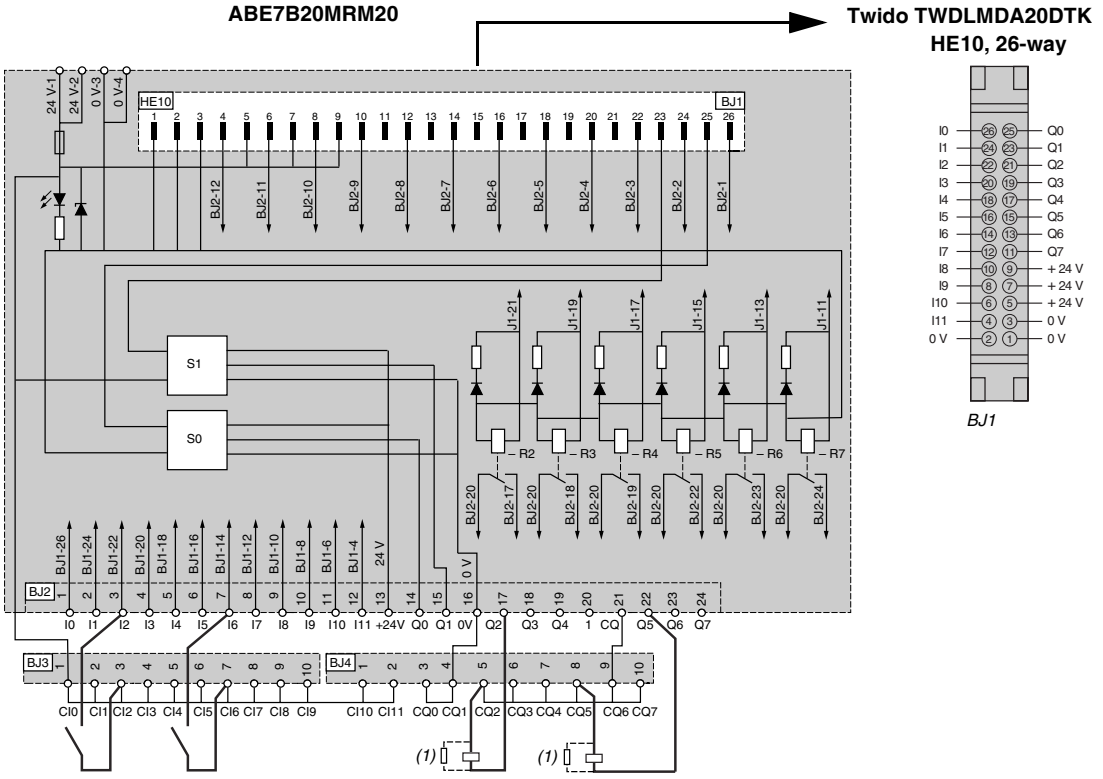
(1) Example of output connections.
When connecting an inductive load, include a diode or a varistor.

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



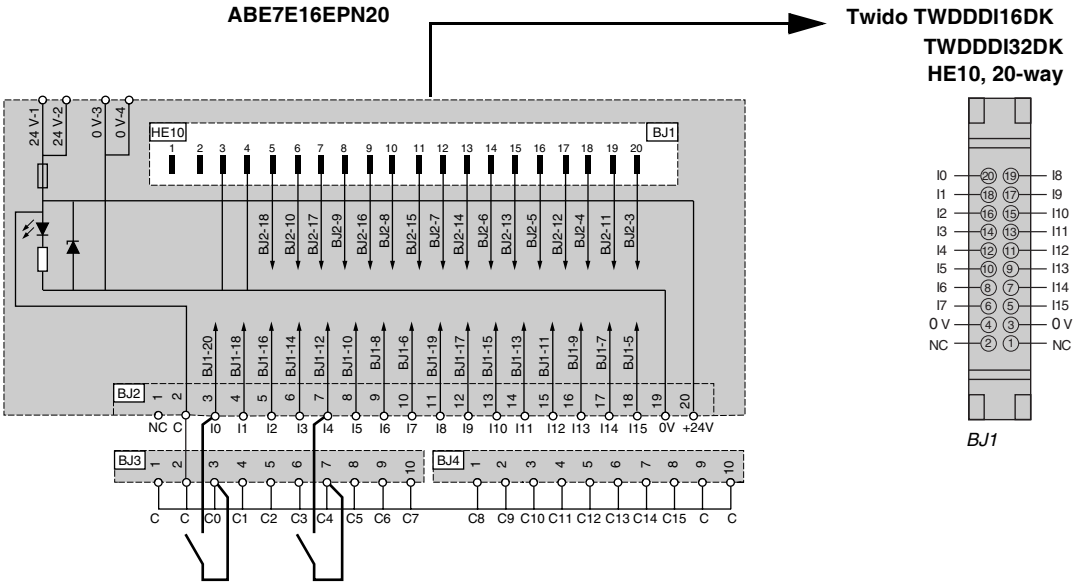
(1) Example of output connections.
When connecting an inductive load, include a diode or a varistor.

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



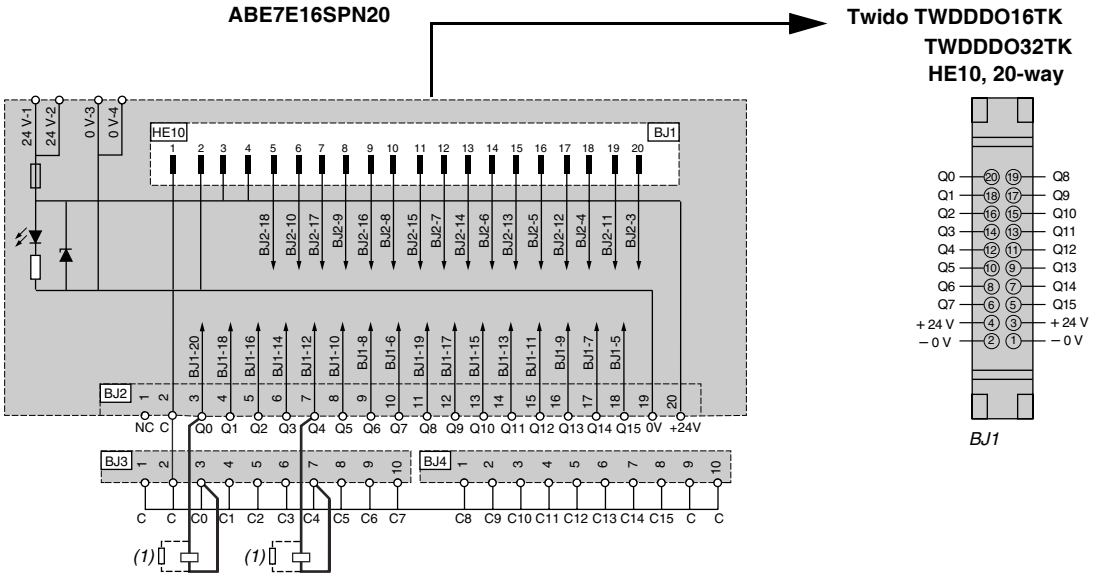
(1) Example of output connections.
When connecting an inductive load, include a diode or a varistor.

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



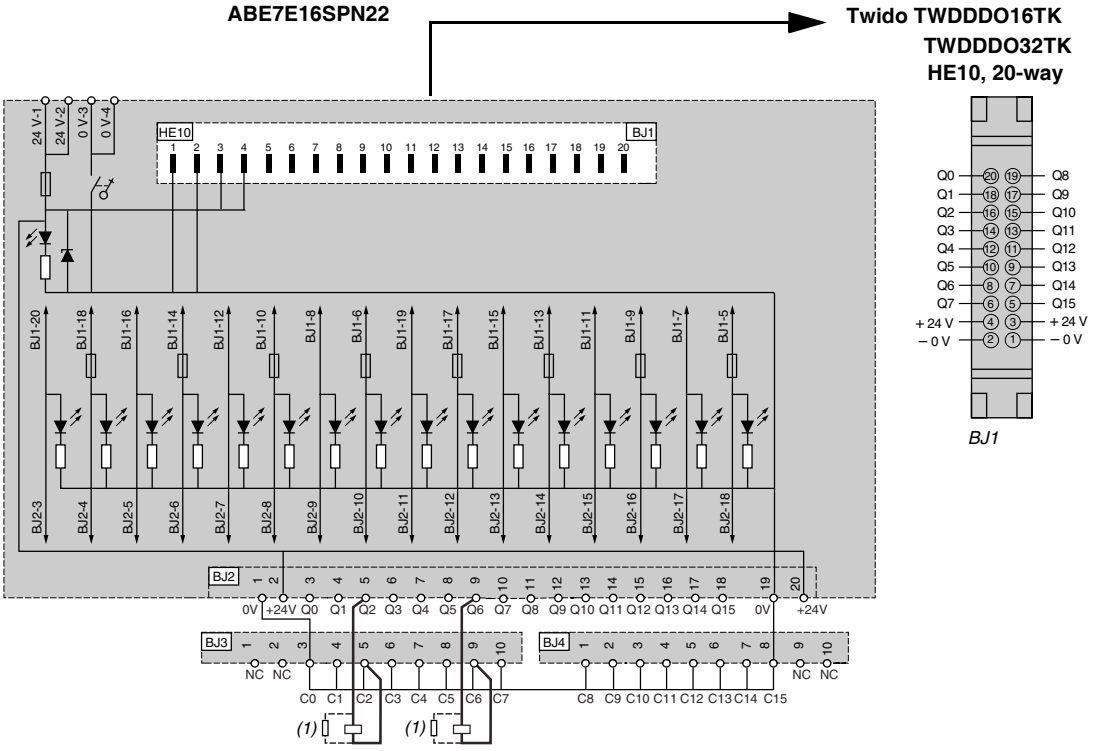
(1) Example of output connections.
When connecting an inductive load, include a diode or a varistor.

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.

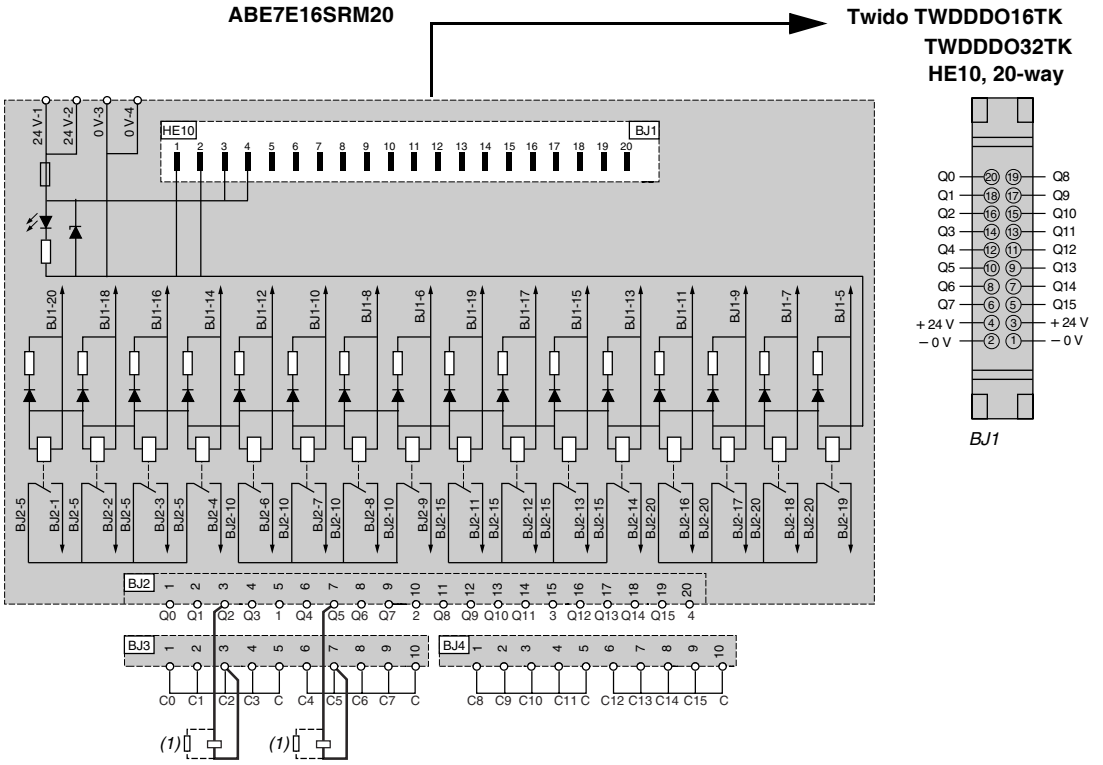
ABE7E16SPN22 The following diagram provides specifications for the ABE7E16SPN22 Telefast® base wiring.



(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.

Wiring Specifications for the TeleFast Cables

Introduction

This section provides cable wiring specifications for the TWDFCW30K/50K and TWDFCW30M/50M TeleFast cables that connect to Twido controllers discrete I/Os.

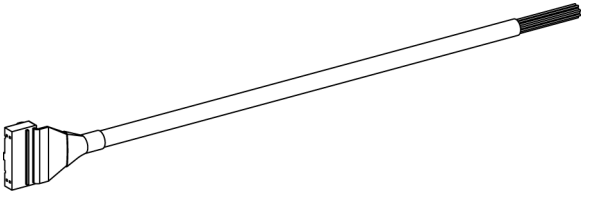
TWDFCW30K/ 50K

The following table provides specifications for the TWDFCW30K/50K with free wires for 20-pin Modular controller.

Pin Connector A Twido Connector Side	Wire Color
1	White
2	Brown
3	Green
4	Yellow
5	Grey
6	Pink
7	Blue
8	Red
9	Black
10	Violet
11	Grey/Pink
12	Red/Blue
13	White/Green
14	Brown/Green
15	White/Yellow
16	Yellow/Brown
17	White/Grey
18	Grey/Brown
19	White/Pink
20	Pink/Brown

Illustration

Illustration of a TWDFCW30K cable:



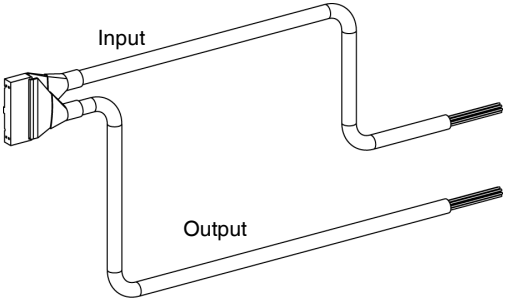
TWDFCW30M/ 50M

The following table provides specifications for the TWDFCW30M/50M cable with free wires for 26-pin Modular controller.

Pin Connector A Twido Connector Side	Wire Color for Input	Wire Color for Output
26	Brown/Black	
24	Brown/Red	
22	Brown/Blue	
20	Pink/Brown	
18	Grey/Brown	
16	Yellow/Brown	
14	Brown/Green	
12	Red/Blue	
10	Violet	
8	Red	
6	Pink	
4	Yellow	
2	Brown	
25		White/Black
23		White/Red
21		White/Blue
19		White/Pink
17		White/Grey
15		White/Yellow
13		White/Green
11		Grey/Pink
9		No Connect
7		Blue
5		Grey
3		Green
1		White

Illustration

Illustration of a TWDFCW30M cable:



Controller Operation

6

At a Glance

Introduction

This chapter provides information about dedicated I/O and the controller operating modes.

What's in this Chapter?

This chapter contains the following sections:

6.1 Dedicated I/Os

At a Glance

Introduction

This section provides information about I/O assignments and capabilities for the RUN/STOP input, controller status output, latching input, counters (FC and VFC), PLS and PWM outputs.

What's in this Section?

This section 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 anyone 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 1 of 3 outputs (%Q0.0.1 to %Q0.0.3) on a base or a remote controller.

At power up, if there is no controller error see *Base status, p. 225*, 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 discrete I/O. The fast counter functions enable counting of pulses from 0 to 65535 in single-word mode and from 0 to 4294967295 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

Discrete I/O Assignment for a Fast Counter

The discrete I/O assignment for fast counters depends on whether discrete I/O was assigned for the optional pre-set and catch inputs on the very fast counters. See *Very Fast Counters, p. 186* 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 4294967295 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

discrete 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

Discrete 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 %Q0.0.0 or %Q0.0.1. This signal has a constant period with the possibility of varying the duty cycle, or on to off ratio.

Controllers PWM Capabilities

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

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

6.2 Controller Operating Modes

At a Glance

Introduction

This section provides information about scanning, operating modes, power supply cut, up and restoration, warm and cold start, and objects initialization.

What's in this Section?

This section contains the following topics:

Cyclic Scan

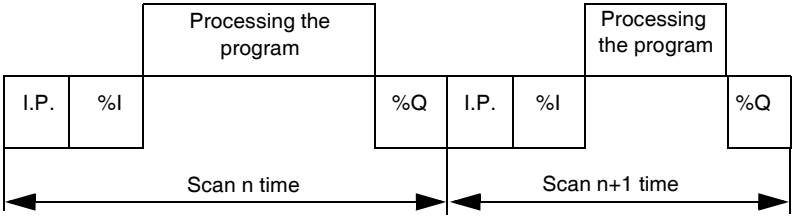
Introduction

Cyclic scanning involves linking controller cycles together one after the other. After having effected the output update (third phase of the task cycle), the system executes a certain number of its own tasks and immediately triggers another task cycle.

Note: The scan time of the user program is monitored by the controller watchdog timer and must not exceed 500 ms. Otherwise a fault appears causing the controller to stop immediately in Halt mode. Outputs in this mode are forced to their default fallback state.

Operation

The following drawing shows the running phases of the cyclical scan time.



Description of the phases of a cycle

The following table describes the phases of a cycle.

Address	Phase	Description
I.P.	Internal processing	The system implicitly monitors the controller (managing system bits and words, updating current timer values, updating status lights, detecting RUN/STOP switches, etc.) and processes requests from TwidoSuite (modifications and animation).
%I, %IW	Acquisition of input	Writing to the memory the status of discrete and application specific module inputs.
-	Program processing	Running the application program written by the user.
%Q, %QW	Updating of output	Writing output bits or words associated with discrete and application specific modules.

Operating mode

Controller in RUN, the processor carries out:

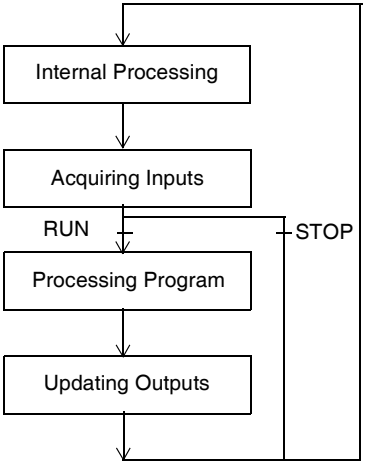
- Internal processing
- Acquisition of input
- Processing the application program
- Updating of output

Controller in STOP, the processor carries out:

- Internal processing
- Acquisition of input

Illustration

The following illustration shows the operating cycles.



Check Cycle

The check cycle is performed by watchdog.

Periodic Scan

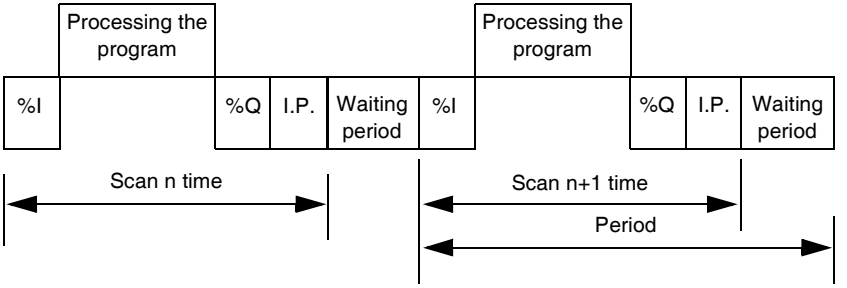
Introduction

In this operating mode, acquiring inputs, processing the application program, and updating outputs are done periodically according to the time defined at configuration (from 2-150 ms).

At the beginning of the controller scan, a timer, the value of which is initialized at the period defined at configuration, starts to count down. The controller scan must end before the timer has finished and relaunches a new scan.

Operation

The following drawing shows the running phases of the periodic scan time.



Description of Operating Phases

The table below describes the operating phases.

Address	Phase	Description
I.P.	Internal processing	The system implicitly monitors the controller (managing system bits and words, updating current timer values, updating status lights, detecting RUN/STOP switches, etc.) and processes requests from TwidoSuite (modifications and animation).
%I, %IW	Acquisition of input	Writing to the memory the status of discrete and application specific module inputs.
-	Program processing	Running the application program written by the user.
%Q, %QW	Updating of output	Writing output bits or words associated with discrete and application specific modules.

Operating mode

Controller in RUN, the processor carries out:

- Internal processing
- Acquisition of input
- Processing the application program
- Updating of output

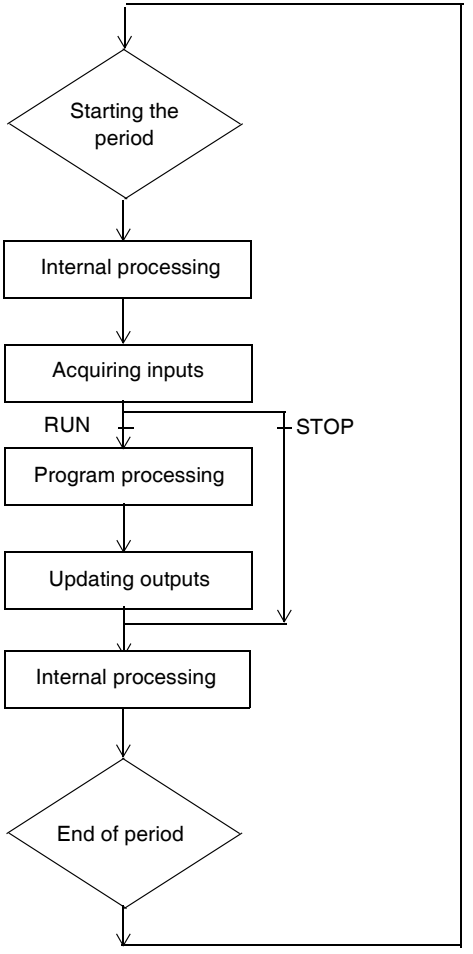
If the period has not finished, the processor completes its operating cycle until the end of the internal processing period. If the operating time is longer than that allocated to the period, the controller indicates that the period has been exceeded by setting the system bit %S19 to 1. The process continues and is run completely. However, it must not exceed the watchdog time limit. The following scan is linked in after writing the outputs of the scan in progress implicitly.

Controller in STOP, the processor carries out:

- Internal processing
- Acquisition of input

Illustration

The following illustration shows the operating cycles.



Check Cycle

Two checks are carried out:

- Period overflow
- Watchdog

Checking Scan Time

General

The task cycle is monitored by a watchdog timer called Tmax (a maximal duration of the task cycle). It permits the showing of application errors (infinite loops, and so on.) and assures a maximal duration for output refreshing.

Software WatchDog (Periodic or Cyclic Operation)

In periodic or cyclic operation, the triggering of the watchdog causes a software error. The application passes into a HALT state and sets system bit %S11 to 1. The relaunching of the task necessitates a connection to TwidoSuite in order to analyze the cause of the error, modification of the application to correct the error, then reset the program to RUN.

Note: The HALT state is when the application is stopped immediately because of an application software error such as a scan overrun. The data retains the current values, which allows for an analysis of the cause of the error. The program stops on the instruction in progress. Communication with the controller is open.

Check on Periodic Operation

In periodic operation an additional check is used to detect the period being exceeded:

- **%S19** indicates that the period has been exceeded. It is set to:
  - 1 by the system when the scan time is greater that the task period,
  - 0 by the user.
- **%SW0** contains the period value (0-150 ms). It is:
  - Initialized when starting from a cold start by the value selected on the configuration,
  - Able to be modified by the user.

Using Master Task Running Time

The following system words are used for information on the controller scan cycle time:

- **%SW11** initializes to the maximum watchdog time (10 to 500 ms).
- **%SW30** contains the execution time for the last controller scan cycle.
- **%SW31** contains the execution time for the longest controller scan cycle since the last cold start.
- **%SW32** contains the execution time for the shortest controller scan cycle since the last cold start.

Note: This different information can also be accessed from the configuration editor.

Operating Modes

Introduction

TwidoSuite is used to take into account the three main operating mode groups:
- Checking
- Running or production
- Stopping

Starting through Grafcet

These different operating modes can be obtained either starting from or using the following Grafcet methods:
- Grafcet initialization
- Presetting of steps
- Maintaining a situation
- Freezing charts

Preliminary processing and use of system bits ensure effective operating mode management without complicating and overburdening the user program.

Grafcet System Bits

Use of bits %S21, %S22 and %S23 is reserved for preliminary processing only. These bits are automatically reset by the system. They must be written by Set Instruction **S** only.

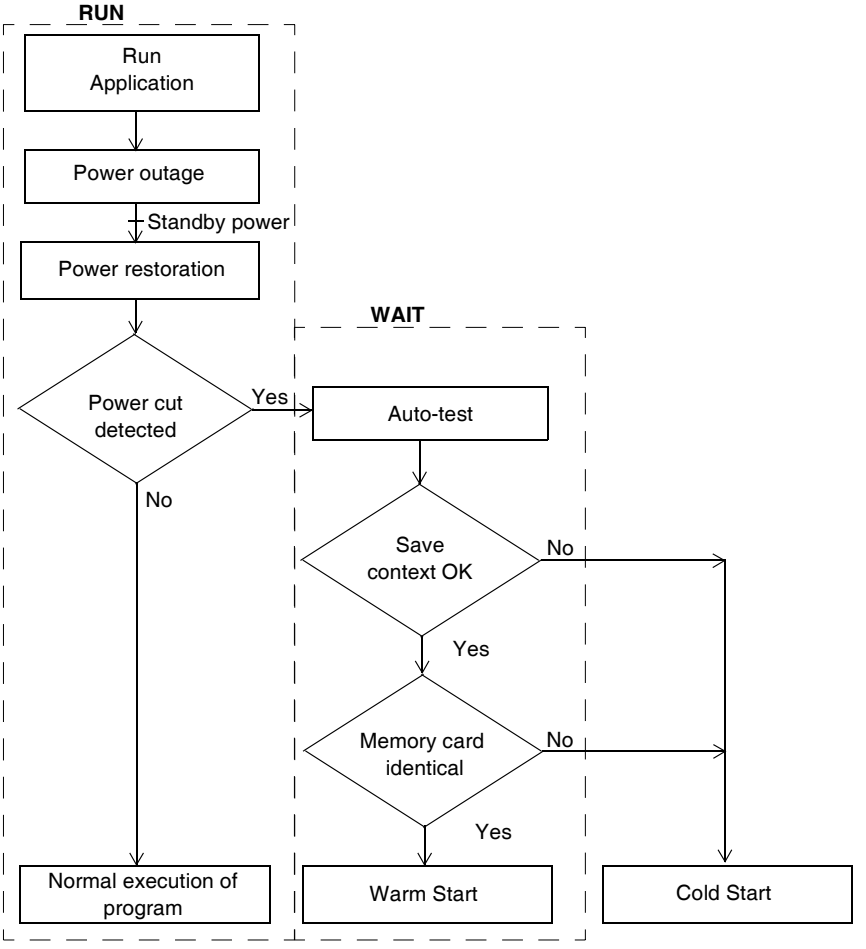
The following table provides Grafcet-related system bits:

Bit	Function	Description
%S21	GRAFCET initialization	Normally set to 0, it is set to 1 by: ● a cold-start, **%S0=1**; ● The user, in the pre-processing program part only, using a Set Instruction **S %S21** or a set coil **-(S)- %S21**. Consequences: ● Deactivation of all active steps. ● Activation of all initial steps.
%S22	GRAFCET RESET	Normally set to 0, it can only be set to 1 by the program in pre-processing. Consequences: ● Deactivation of all active steps. ● Scanning of sequential processing stopped.
%S23	Preset and freeze GRAFCET	Normally set to 0, it can only be set to 1 by the program in pre-processing. ● Prepositioning by setting %S22 to 1. ● Preposition the steps to be activated by a series of S Xi instructions. ● Enable prepositioning by setting %S23 to 1. Freezing a situation: ● In initial situation: by maintaining %S21 at 1 by program. ● In an "empty" situation: by maintaining %S22 at 1 by program. ● In a situation determined by maintaining %S23 at 1.

Dealing with Power Cuts and Power Restoration

Illustration

The following illustration shows the various power restarts detected by the system. If the duration of the cut is less than the power supply filtering time (about 10 ms for an alternating current supply or 1 ms for a direct current supply), this is not noticed by the program which runs normally.



Note: The context is saved in a battery backed-up RAM. At power up, the system checks the state of the battery and the saved context to decide if a warm start can occur.

Run/Stop Input Bit Versus Auto Run

The Run/Stop input bit has priority over the "Automatic Start in Run" option that is available from the Scan Mode dialog box. If the Run/Stop bit is set, then the controller will restart in the Run Mode when power is restored.

The mode of the controller is determined as follows:

Run/Stop Input Bit	Auto Start in Run	Resulting State
Zero	Zero	Stop
Zero	One	Stop
Rising edge	No effect	Run
One	No effect	Run
Not configured in software	Zero	Stop
Not configured in software	One	Run

Note: For all Compact type of controllers of software version V1.0, if the controller was in Run mode when power was interrupted, and the "Automatic Start in Run" flag was not set from the Scan Mode dialog box, the controller will restart in Stop mode when power is restored. Otherwise will perform a cold restart.

Note: For all Modular and Compact type of controllers of software version V1.11, if the battery in the controller is operating normally when power was interrupted, the controller will startup in the mode that was in effect at the time the power was interrupted. The "Automatic Start in Run" flag, that was selected from the Scan Mode dialog, will have no effect on the mode when the power is restored.

Operation

The table below describes the processing phases for power cuts.

Phase	Description
1	In the event of a power cut the system stores the application context and the time of the cut.
2	All outputs are set to fallback status (0).
3	When power is restored, the context saved is compared with the one in progress which defines the type of start to run: • If the application context has changed (loss of system context or new application), the controller initializes the application: Cold restart (systematic for compact). • If the application context is the same, the controller restarts without initializing data: warm restart.

Dealing with a warm restart

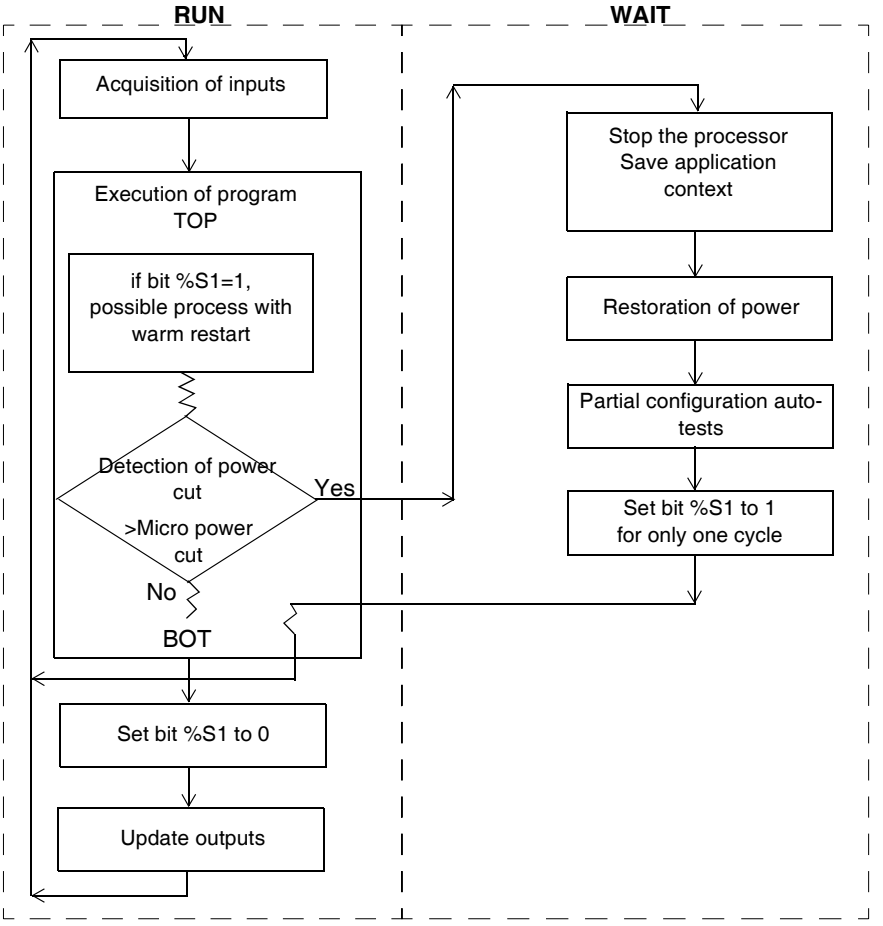
Cause of a Warm Restart

A warm restart can occur:

- When power is restored without loss of application context,
- When bit **%S1** is set to state 1 by the program,
- From the Operator Display when the controller is in STOP mode

Illustration

The drawing below describes a warm restart operation in RUN mode.



Restart of the Program Execution

The table below describes the restart phases for running a program after a warm restart.

Phase	Description
1	The program execution resumes from the same element where it was prior to the power cut, without updating the outputs. **Note:** Only the same element from the user code is restarted. The system code (for example, the updating of outputs) is not restarted.
2	At the end of the restart cycle, the system: ● Unreserves the application if it was reserved (and provokes a STOP application in case of debugging) ● Reinitializes the messages
3	The system carries out a restart cycle in which it: ● Relaunches the task with bits **%S1** (warm-start indicator) and **%S13** (first cycle in RUN) set to 1 ● Resets bits **%S1** and **%S13** to 0 at the end of the first task cycle

Processing of a Warm-Start

In the event of a warm-start, if a particular application process is required, bit **%S1** must be tested at the start of the task cycle, and the corresponding program called up.

Outputs after Power Failure

Once a power outage is detected, outputs are set to (default) fallback status (0).

When power is restored, outputs are at last state until they are updated again by the task.

Dealing with a cold start

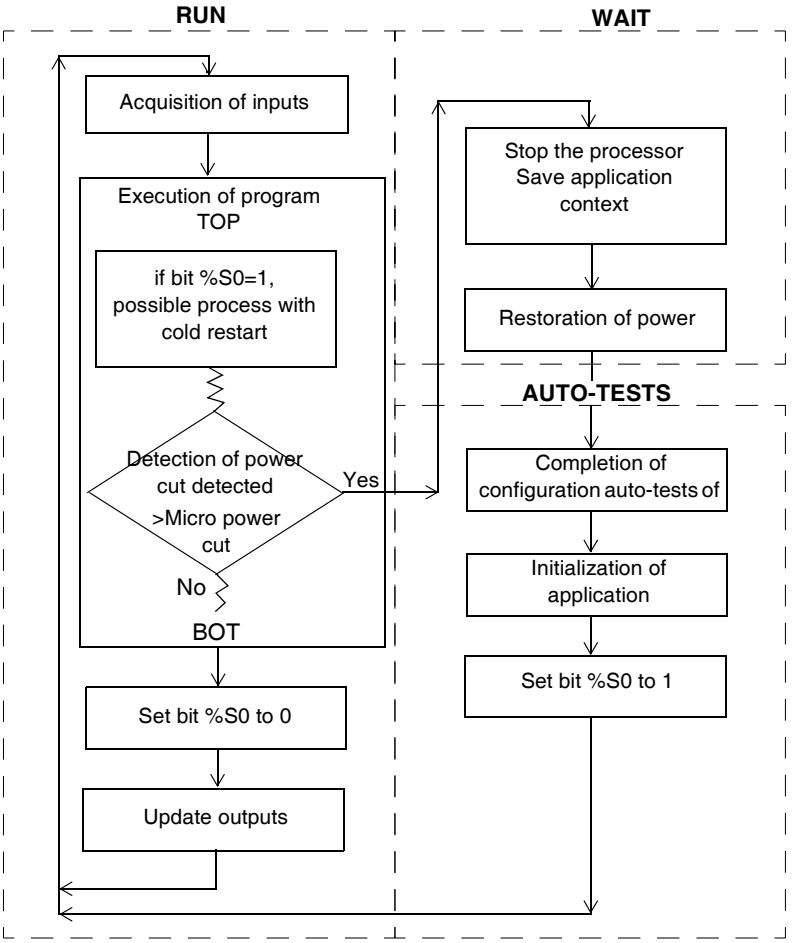
Cause of a Cold Start

A cold-start can occur:

- When loading a new application into RAM
- When power is restored with loss of application context
- When system bit **%S0** is set to state 1 by the program
- From the Operator Display when the controller is in STOP mode

Illustration

The drawing below describes a cold restart operation in RUN mode.



Operation

The table below describes the restart phases for running a program after a cold restart.

Phase	Description
1	At start up, the controller is in RUN. At a cold restart after a stop due to an error, the system forces a cold restart. The program execution restarts at the beginning of the cycle.
2	The system: ● Resets internal bits and words and the I/O images to 0 ● Initializes system bits and words ● Initializes function blocks from configuration data
3	For this first restart cycle, the system: ● Relaunches the task with bits **%S0** (cold-start indicator) and **%S13** (first cycle in RUN) set to 1 ● Resets bits **%S0** and **%S13** to 0 at the end of this first task cycle ● Sets bits **%S31** and **%S38** (event control indicators) to their initial state 1. ● Resets bits **%S39** (event control indicator) and word **%SW48** (counts all events executed except periodic events).

Processing of a Cold-Start

In the event of a cold-start, if a particular application process is required, bit **%S0** (which is at 1) must be tested during the first cycle of the task.

Outputs after Power Failure

Once a power outage is detected, outputs are set to (default) fallback status (0).

When power is restored, outputs are at zero until they are updated again by the task.

Initialization of objects

Introduction

The controllers can be initialized by TwidoSuite by setting system bits **%S0** (a cold restart) and **%S1** (a warm restart).

Cold Start Initialization

For a cold start initialization, system bit **%S0** must be set to 1.

Initialization of objects (identical to cold start) on power-up using %S0 and %S1

To initialize objects on power-up, system bit **%S1** and **%S0** must be set to 1.

The following example shows how to program a warm restart object initialization using system bits.


```
LD  %S1   If %S1 = 1 (warm restart), set %S0 to 1 initialize the controller.
ST  %S0   These two bits are reset to 0 by the system at the end of the
          following scan.
```

Note: Do not set %S0 to 1 for more than one controller scan.

Operator Display Operation

7

At a Glance

Introduction

This appendix provides an overview, information about operator display controller ID, system objects, serial port settings, time of day clock, and real-time correction .

What's in this Chapter?

This chapter contains the following topics:

Operator Display

Introduction

The Operator Display is a Twido option for displaying and controlling application data and some controller functions such as operating state and the Real-Time Clock (RTC). This option is available as a cartridge (TWDXCPODC) for the Compact controllers or as an expansion module (TWDXCPODM) for the Modular controllers.

The Operator Display has two operating modes:

- Display Mode: only displays data.
- Edit mode: allows you to change data.

Note: The operator display is updated at a specific interval of the controller scan cycle. This can cause confusion in interpreting the display of dedicated outputs for %PLS or %PWM pulses. At the time these outputs are sampled, their value will always be zero, and this value will be displayed.

Displays and Functions

The Operator Display provides the following separate displays with the associated functions you can perform for each display.

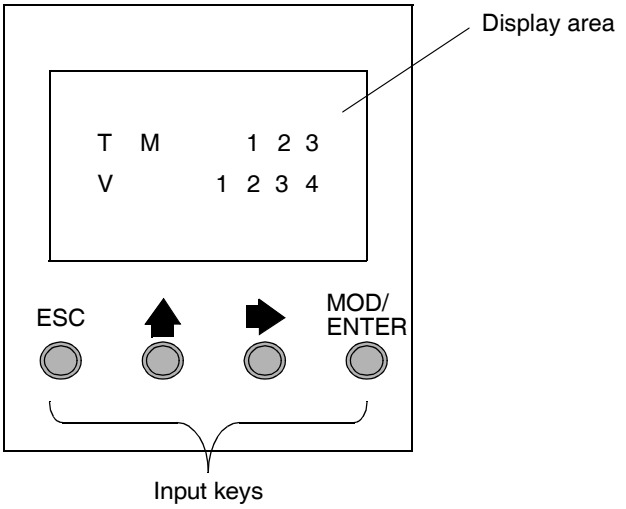
- Controller Identification and State Information: Operations Display
  Display firmware revision and the controller state. Change the controller state with the Run, Initial, and Stop commands.
- System Objects and Variables: Data Display
  Select application data by the address: %I, %Q, and all other software objects on the base controller. Monitor and change the value of a selected software data object.
- Serial Port Settings: Communication Display
  Display and modify communication port settings.
- Time of Day Clock: Time/Date Display
  Display and configure the current date and time (if the RTC is installed).
- Real Time Correction: RTC Factor
  Display and modify the RTC Correction value for the optional RTC.

Note:

1. The TWDLCA•40DRF series of compact controllers have RTC onboard.
2. On all other controllers, time of day clock and real-time correction are only available if the Real-Time Clock (RTC) option cartridge (TWDXCPRTC) is installed.

Illustration

The following illustration shows a view of the Operator Display, which consists of a display area (here in Normal mode) and four push-button input keys.



Display area

The Operator Display provides an LCD display capable of displaying two lines of characters:

- The first line of the display has three 13-segment characters and four 7-segment characters.
- The second line has one 13-segment character, one 3-segment character (for a plus/minus sign), and five 7-segment characters.

Note: If in Normal mode, the first line indicates an object name and the second line displays its value. If in Data mode, the first line displays %SW68 value and the second line displays %SW69 value.

Input keys

The functions of the four input push-buttons depend on the Operator Display mode.

Key	In Display Mode	In Edit Mode
ESC		Discard changes and return to previous display.
▲		Go to the next value of an object being edited.
➡	Advance to next display.	Go to the next object type to edit.
MOD/ ENTER	Go to edit mode.	Accept changes and return to previous display.

Selecting and Navigating the Displays

The initial display or screen of the Operator Display shows the controller identification and state information. Press the ➡ push-button to sequence through each of the displays. The screens for the Time of Day Clock or the Real-Time Correction Factor are not displayed if the optional RTC cartridge (TWDXCPRTC) is not detected on the controller.

As a shortcut, press the ESC key to return to the initial display screen. For most screens, pressing the ESC key will return to the Controller Identification and State Information screen. Only when editing System Objects and Variables that are not the initial entry (%I0.0.0), will pressing ESC take you to the first or initial system object entry.

To modify an object value, instead of pressing the ➡ push-button to go to the first value digit, press the MOD/ENTER key again.

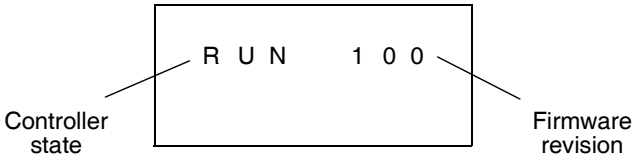
Controller Identification and State Information

Introduction

The initial display or screen of the Twido optional Operator Display shows the Controller Identification and State Information.

Example

The firmware revision is displayed in the upper-right corner of the display area, and the controller state is displayed in the upper-left corner of the display area, as seen in the following:



Controller States

Controller states include any of the following:

- **NCF: Not Configured**
  The controller is in the NCF state until an application is loaded. No other state is allowed until an application program is loaded. You can test the I/O by modifying system bit S8. (see the Programming Guide for additional information about System Bits and System Words.)
- **STP: Stopped**
  Once an application is present in the controller, the state changes to the STP or Stopped state. In this state, the application is not running. Inputs are updated and data values are held at their last value. Outputs are not updated in this state.
- **INI: Initial**
  You can choose to change the controller to the INI or initial state only from the STP state. The application is not running. The controller's inputs are updated and data values are set to their initial state. No outputs are updated from this state.
- **RUN: Running**
  When in the RUN or running state the application is running. The controller's inputs are updated and data values are set according to the application. This is the only state where the outputs are updated.
- **HLT: Halted (User Application Error)**
  If the controller has entered an ERR or error state, the application is halted. Inputs are updated and data values are held at their last value. From this state, outputs are not updated. In this mode, the error code is displayed in the lower-right portion of the Operator Display as an unsigned decimal value.
- **NEX: Not Executable (not executable)**
  An online modification was made to user logic. Consequences: The application is no longer executable. It will not go back into this state until all causes for the Non-Executable state have been resolved.

Displaying and Changing Controller States

Using the Operator Display, you can change to the INI state from the STP state, or from STP to RUN, or from RUN to STP. Do the following to change the state of the controller:

Step	Action
1	Press the ➡ key until the Operations Display is shown (or press ESC). The current controller state is displayed in the upper-left corner of the display area.
2	Press the MOD/ENTER key to enter edit mode.
3	Press the ⬆ key to select a controller state.
4	Press the MOD/ENTER key to accept the modified value, or press the ESC key to discard any modifications made while in edit mode.

System Objects and Variables

Introduction

The optional Operator Display provides these features for monitoring and adjusting application data:

- Select application data by address (such as %I or %Q).
- Monitor the value of a selected software object/variable.
- Change the value of the currently displayed data object (including forcing inputs and outputs).

System Objects and Variables

The following table lists the system objects and variables, in the order accessed, that can be displayed and modified by the Operator Display.

Object	Variable/Attribute	Description	Access
Input	%Ix.y.z	Value	Read/Force
Output	%Qx.y.z	Value	Read/Write/Force
Timer	%TMX.V %TMX.P %TMX.Q	Current Value Preset value Done	Read/Write Read/Write Read
Counter	%Cx.V %Cx.P %Cx.D %Cx.E %Cx.F	Current Value Preset value Done Empty Full	Read/Write Read/Write Read Read Read
Memory Bit	%Mx	Value	Read/Write
Word Memory	%MWx(3)	Value	Read/Write
Constant Word	%KWx	Value	Read
System Bit	%Sx	Value	Read/Write
System Word	%SWx(4)	Value	Read/Write
Analog Input	%IWx.y.z	Value	Read
Analog Output	%QWx.y.z	Value	Read/Write
Fast Counter	%FCx.V %FCx.VD(1) %FCx.P %FCx.PD(1) %FCx.D	Current Value Current Value Preset value Preset value Done	Read Read Read/Write Read/Write Read

Object	Variable/Attribute	Description	Access
Very Fast Counter	%VFCx.V %VFCx.VD(1) %VFCx.P %VFCx.PD(1) %VFCx.U %VFCx.C %VFCx.CD(1) %VFCx.S0 %VFCx.S0D(1) %VFCx.S1 %VFCx.S1D(1) %VFCx.F %VFCx.T %VFCx.R %VFCx.S	Current Value Current Value Preset value Preset value Count Direction Catch Value Catch Value Threshold 0 Value Threshold 0 Value Threshold Value1 Threshold Value1 Overflow Timebase Reflex Output Enable Reflex Input Enable	Read Read Read/Write Read/Write Read Read Read Read/Write Read/Write Read/Write Read/Write Read Read/Write Read/Write Read/Write
Input Network Word	%INWx.z	Value	Read
Output Network Word	%QNWx.z	Value	Read/Write
Grafcet	%Xx	Step Bit	Read
Pulse Generator	%PLS.N %PLS.ND(1) %PLS.P(5) %PLS.D %PLS.Q	Number of Pulses Number of Pulses Preset value Done Current Output	Read/Write Read/Write Read/Write Read Read
Pulse Width Modulator	%PWM.R %PWM.P	Ratio Preset value	Read/Write Read/Write
Drum Controller	%DRx.S %DRx.F	Current Step Number Full	Read Read
Step counter	%SCx.n	Step Counter bit	Read/Write
Register	%Rx.I %Rx.O %Rx.E %Rx.F	Input Output Empty Full	Read/Write Read/Write Read Read
Shift bit register	%SBR.x.yy	Register Bit	Read/Write
Message	%MSGx.D %MSGx.E	Done Error	Read Read
AS-Interface slave input	%IAx.y.z	Value	Read/Force
AS-Interface analog slave input	%IWAx.y.z	Value	Read
AS-Interface slave output	%QAx.y.z	Value	Read/Write/Force
AS-Interface analog slave output	%QWAx.y.z	Value	Read/Write
CANopen slave PDO input	%IWCx.y.z	Single-word value	Read
CANopen slave PDO output	%QWCx.y.z	Single-word value	Read/Write

Notes:

1. 32-bit double word variable. The double word option is available on all controllers with the exception of the Twido TWDLC•A10DRF controllers.
2. Variables will not be displayed if they are not used in an application since Twido uses dynamic memory allocation.
3. If the value of %MW is greater than +32767 or less than -32768, the operator display will continue to blink.
4. If the value of %SW is greater than 65535, the operator display continues to blink, except for %SW0 and %SW11. If a value is entered that is more than the limit, the value will return to the configured value.
5. If a value is entered for %PLS.P that is more than the limit, the value written is the saturation value.

Displaying and Modifying Objects and Variables

Each type of system object is accessed by starting with the Input Object (%I), sequencing through to the Message object (%MSG), and finally looping back to the Input Object (%I).

To display a system object:

Step	Action
1	Press the ➡ key until the Data Display screen is shown. The Input object ("I") will be displayed in the upper left corner of the display area. The letter " I " (or the name of the object previously viewed as data) is not blinking.
2	Press the MOD/ENTER key to enter edit mode. The Input Object "I" character (or previous object name viewed as data) begins blinking.
3	Press the ⬆ key to step sequentially through the list of objects.
4	Press the ➡ key to step sequentially through the field of an object type and press the ⬆ key to increment through the value of that field. You can use the ➡ key and ⬆ key to navigate and modify all fields of the displayed object.
5	Repeat steps 3 and 4 until editing is complete.
6	Press the MOD/ENTER key to accept the modified values. Note: The object's name and address have to be validated before accepting any modifications. That is, they must exist in the configuration of the controller prior to using the operator display. Press ESC to discard any changes made in edit mode.

Data Values and Display Formats

In general, the data value for an object or variable is shown as a signed or unsigned integer in the lower-right of the display area. In addition, all fields suppress leading zeros for displayed values. The address of each object is displayed on the Operator Display in one of the following 8 formats:

- Input/Output format
- AS-Interface slaves I/O format
- CANopen slaves I/O format
- Function block format
- Simple format
- Network I/O format
- Step Counter Format
- Shift Bit Register format

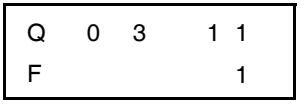
Input/Output Format

The input/output objects (%I, %Q, %IW and %QW) have three-part addresses (e.g.: %IX.Y.Z) and are displayed as follows:

- Object type and controller address in the upper-left
- Expansion address in the upper-center
- I/O channel in the upper-right

In the case of a simple input (%I) and output (%Q), the lower-left portion of the display will contain a character that is either "U" for unforced or "F" for a forced bit. The force value is displayed in the lower-right of the screen.

The output object %Q0.3.11 appears in the display area as follows:



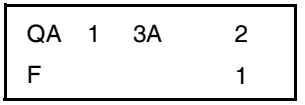
AS-Interface Slaves I/O Format

AS-Interface slave I/O objects (%IA, %QA, %IWA and %QWA) have four-part addresses (e.g.: %IAx.y.z) and are displayed as follows:

- The object type in the upper-left
- AS-Interface master address on the expansion bus in the upper-left center
- Address of the slave on the AS-Interface bus in the upper-right center
- Slave I/O channel in the upper-right.

In the case of a simple input (%IA) and output (%QA), the lower-left portion of the display will contain a character that is either "U" for unforced or "F" for a forced bit. The force value is displayed in the lower-right of the screen.

The output object %QA1.3A.2 appears in the display area as follows:

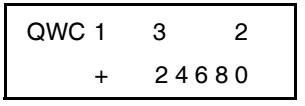


CANopen Slaves I/O Format

CANopen slave PDO I/O objects (%IWC and %QWC) have four-part addresses (e.g.: %IWCx.y.z) and are displayed as follows:

- The object type in the upper-left
- CANopen master address on the expansion bus in the upper-left center
- Address of the slave on the CANopen bus in the upper-right center
- Slave PDO I/O channel in the upper-right.
- Signed value for the object in the lower portion

In the following example, the PDO output object %QWC1.3.2 contains the signed value +24680:



Function Block Format

The function blocks (%TM, %C, %FC, %VFC, %PLS, %PWM, %DR, %R, and %MSGj) have two-part addresses containing an object number and a variable or attribute name. They are displayed as follows:

- Function block name in the upper-left
- Function block number (or instance) in the upper-right
- The variable or attribute in the lower-left
- Value for the attribute in the lower-right

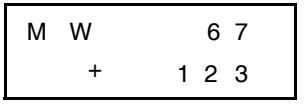
In the following example, the current value for timer number 123 is set to 1,234.

Simple Format

A simple format is used for objects %M, %MW, %KW, %MD, %KD, %MF, %KF, %S, %SW and %X as follows:

- Object number in the upper-right
- Signed value for the objects in the lower portion

In the following example, memory word number 67 contains the value +123.

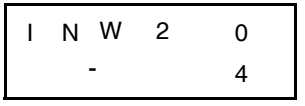


Network I/O Format

The network input/output objects (%INW and %QNW) appear in the display area as follows:

- Object type in the upper-left
- Controller address in the upper-center
- Object number in the upper-right
- Signed value for the object in the lower portion

In the following example, the first input network word of the remote controller configured at remote address #2 is set to a value -4.

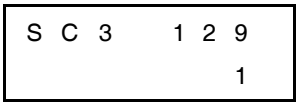


Step Counter Format

The step counter (%SC) format displays the object number and the step counter bit as follows:

- Object name and number in the upper-left
- Step counter bit in the upper right
- The value of the step counter bit in the lower portion of the display

In the following example, bit number 129 of step counter number 3 is set to 1.

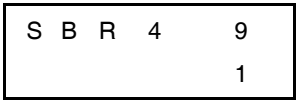


Shift Bit Register Format

The shift bit register (%SBR) appears in the display area as follows:

- Object name and number in the upper-left
- Register bit number in the upper-right
- Register bit value in the lower-right

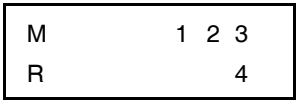
The following example shows the display of shift bit register number 4.



Serial Port Settings

Introduction

The operator display allows you to display the protocol settings and change the addresses of all serial ports configured using TwidoSuite. The maximum number of serial ports is two. In the example below, the first port is configured as Modbus protocol with an address 123. The second serial port is configured as a remote link with an address of 4.



Displaying and Modifying Serial Port Settings

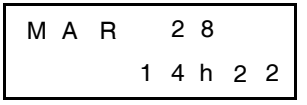
Twido controllers can support up to two serial ports. To display the serial port settings using the operator display:

Step	Action
1	Press the ➡ key until the Communication Display is shown. The single letter of the protocol setting of the first serial port ("M", "R", or "A") will be displayed in the upper left corner of the operator display.
2	Press the MOD/ENTER key to enter the edit mode.
3	Press the ➡ key until you are in the field that you wish to modify.
4	Press the ⬆ key to increment the value of that field.
5	Continue steps 3 and 4 until the address settings are complete.
6	Press the MOD/ENTER key to accept the modified values or ESC to discard any modifications made while in edit mode.
Note: The address is part of the configuration data on the Controller. Changing its value using the operator display means that you can no longer connect using TwidoSuite as equal. TwidoSuite will require that you do a download to become equal again.	

Time of Day Clock

Introduction

You can modify the date and time using the operator display if the RTC option cartridge (TWDXCPRTC) is installed on your Twido controller. The Month is displayed in the upper-left side of the HMI Display. Until a valid time has been entered, the month field will contain the value "RTC". The day of the month is displayed in the upper-right corner of the display. The time of day is in military format. The hours and minutes are shown in the lower-right corner of the display and are separated by the letter "h". The example below shows that the RTC is set to March 28, at 2:22 PM.



Note:
1. The TWDLCA•40DRF series of compact controllers have RTC onboard.
2. On all other controllers, time of day clock and real-time correction are only available if the Real-Time Clock (RTC) option cartridge (TWDXCPRTC) is installed.

Displaying and Modifying Time of Day Clock

To display and modify the Time of Day Clock:

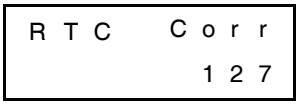
Step	Action
1	Press the ➡ key until the Time/Date Display is shown. The month value ("JAN", "FEB") will be displayed in the upper-left corner of the display area. The value "RTC" will be displayed in the upper-left corner if no month has been initialized.
2	Press the MOD/ENTER key to enter the edit mode.
3	Press the ➡ key until you are in the field that you wish to modify.
4	Press the ⬆ key increment the value of that field.
5	Continue steps 3 and 4 until the Time of Day value is complete.
6	Press the MOD/ENTER key to accept the modified values or ESC to discard any modifications made while in edit mode.

Real-Time Correction Factor

Introduction

You can display and modify the Real-Time Correction Factor using the operator display. Each Real-Time Clock (RTC) Option module has a RTC Correction Factor value that is used to correct for inaccuracies in the RTC module's crystal. The correction factor is an unsigned 3-digit integer from 0 to 127 and is displayed in the lower-right corner of the display.

The example below shows a correction factor of 127.



Displaying and Modifying RTC Correction

To display and modify the Real-Time Correction Factor:

Step	Action
1	Press the ➡ key until the RTC Factor Display is shown. "RTC Corr" will be displayed in the upper line of the operator display.
2	Press the MOD/ENTER key to enter edit mode.
3	Press the ➡ key until you are in the field that you wish to modify.
4	Press the ⬆ key to increment the value of that field.
5	Continue Steps 3 and 4 until the RTC correction value is complete.
6	Press the MOD/ENTER key to accept the modified values or ESC to discard any modifications made while in edit mode.

Appendices

At a Glance

Introduction

This appendix provides information on system diagnostic using LED's, operator display operation, troubleshooting, the DIN rail, common IEC symbols used in this manual, and agency compliance.

What's in this Appendix?

The appendix contains the following chapters:

System Diagnostic using the Front Panel LED's

A

System Diagnostic Using the Front Panel LEDs

Introduction

This section provides information about the base operating status and troubleshooting using the front panel LEDs.

Status of the discrete I/O Module

LED state		Discrete I/O Module
I/O LEDs	◯	I/O not active
	⊗	I/O active
●		

Base status

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

LED status		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

LED status		Base Controller or Peer Controller	Remote I/O 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 bases. (For detailed information about the BAT LED status, please *Battery Power Status, p. 58*.)		
	◯	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 base. (For detailed information about the LAN ACT LED status, please see "link-TBD".)		
	◯	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
LAN ST green	TWDLCAE40DRF Compact base. (For detailed information about the LAN ACT LED status, please see "link-TBD".)		
	◯	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 ● Illuminated			

Troubleshooting

B

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 base 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 base. After the base restarts, the Operator Display indicates "NCF". ● From TwidoSuite, issue the **Erase** command from the **Program** → **Debug** → **Connect** task.
2	With the base in the non-configured state, set system bit %S8 to 0. At state 0, the base 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 the TwidoSuite **Program** → **Debug** → **Check PLC** task, 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 the TwidoSuite **Program** → **Debug** → **Check PLC** task, 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.

The DIN Rail

C

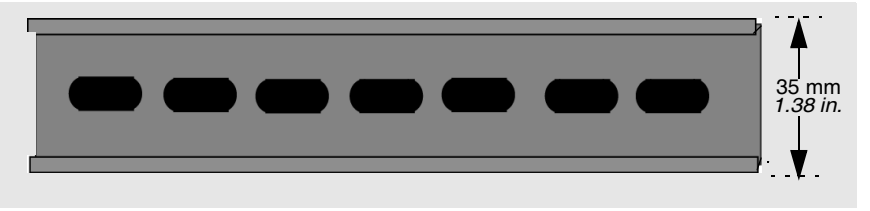
The DIN Rail

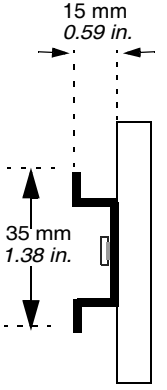
Introduction

You can mount the Twido controller and its expansions on a DIN rail. A DIN rail can be attached to a smooth mounting surface or suspended from a EIA rack or in a NEMA cabinet.

Dimensions of the DIN Rail

The DIN rail measures 35 mm (*1.38 in.*) high and 15 mm (*0.59 in.*) deep, as shown below.





Recommended Equipment

You can order the suitable DIN rail from Schneider Electric:

Rail depth	Catalogue part number
15 mm (*0.59 in.*)	AM1DE200

IEC Symbols

D

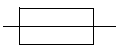
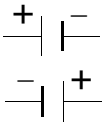
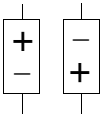
Glossary of Symbols

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
	Discrete sensor/input, for example, contact, switch, initiator, light barrier, and so on.
	Earth ground
	2-wire sensor
	Thermocouple element

Agency Compliance

E

Agency Requirements

Introduction

This section provides agency standards for the Twido products.

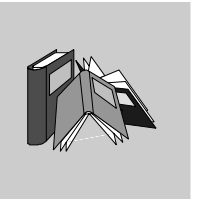
Standards

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

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 discrete 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 discrete 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 discrete I/O. Compact controllers can be equipped with three fast counters. Modular controllers can have two fast counters.
Free Wire	The end of a discrete 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 TwidoSuite.

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 TwidoSuite.
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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