Field I/O

Section 8

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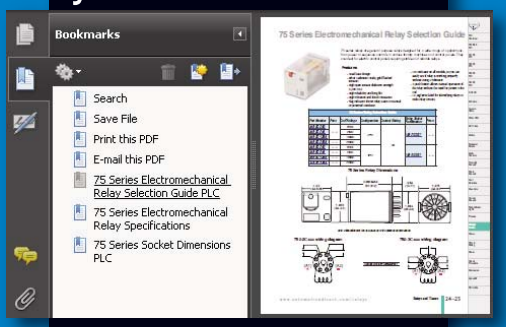

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Field I/O

The Practical Field I/O System: All the Best Features at an AutomationDirect Price

Terminator I/O

What is it?

Terminator I/O is the most practical distributed Field I/O system you can buy. It combines the I/O points with their field terminations into a modular package to save panel space and money. With Terminator I/O, you can distribute I/O nodes close to field devices for faster and more efficient wiring and troubleshooting.

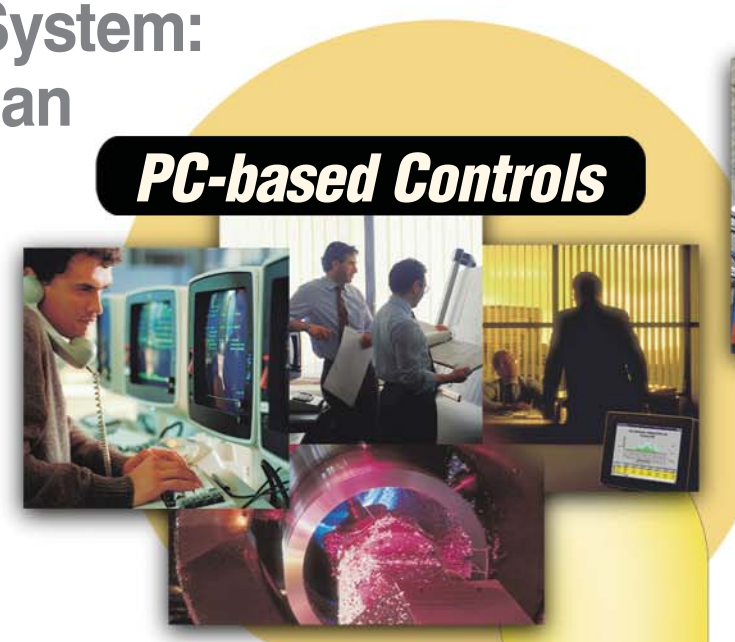
Terminator I/O was custom-designed for us by Koyo (the same people who designed the original GE Series One PLC), a trusted name in control technology since 1983.

What's it got?

- Network interface modules supporting Ethernet, PROFIBUS™, DeviceNet™, Modbus and Koyo remote I/O; some adapters include an on-board RS-232 serial port.
- Discrete and analog I/O modules with modular terminal bases.
- Configuration flexibility by plugging together a network interface module with up to 16 I/O modules. Use local expansion for large I/O drops. No more confining I/O bases.
- AC or DC power supplies. For high power systems, combine multiple supplies on a single I/O set.
- Horizontal or vertical DIN-rail mounting

What can I do with it?

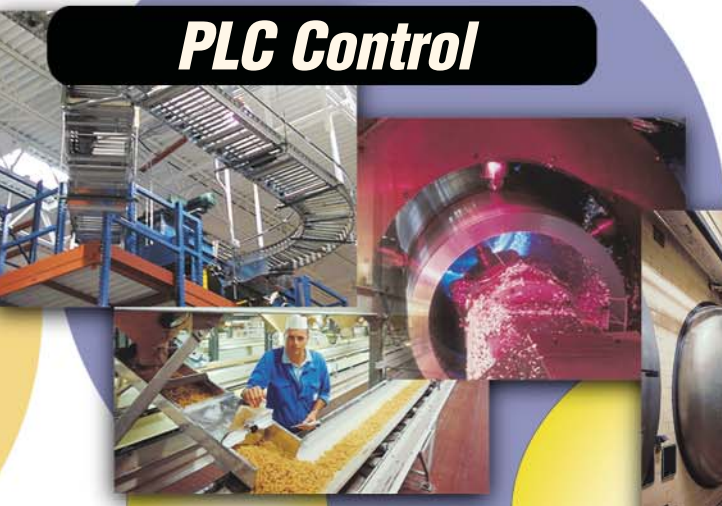
- Use Terminator I/O as robust PLC remote I/O with triple stack terminal bases and hot-swap I/O modules.
- Add Terminator I/O to Allen-Bradley, Siemens, Modicon or GE systems for 1/2 to 1/3 the price of their comparable field I/O products.
- Use Terminator I/O as low-cost field I/O for your SCADA, PC-based control system or WinPLC™ system.



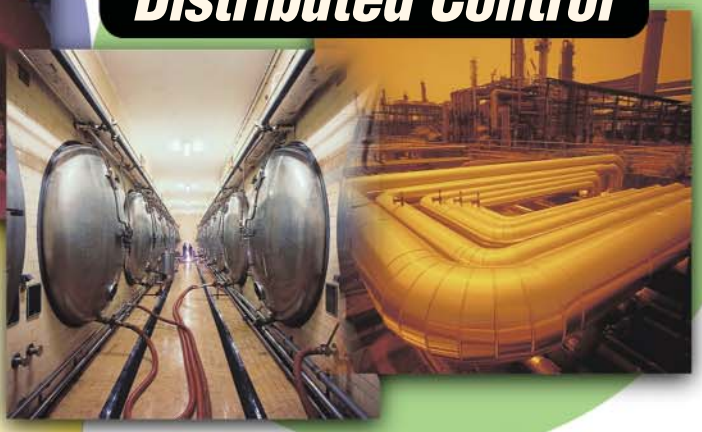
Terminator I/O allows you to connect serial devices, like an operator interface panel, along with your I/O, so there's no need to purchase adapters or run additional wiring*.

* Serial communication options available on T1H-EBC, T1K-RSSS, and T1K-DEVNETS only

PLC Control



Distributed Control



UNIVERSAL I/O

Terminal connectors

Terminator I/O

Output modules have replaceable fuses

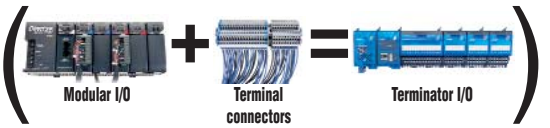
Modules slide into the modular terminal bases. Plug together any combination of modules and power sources for your application.

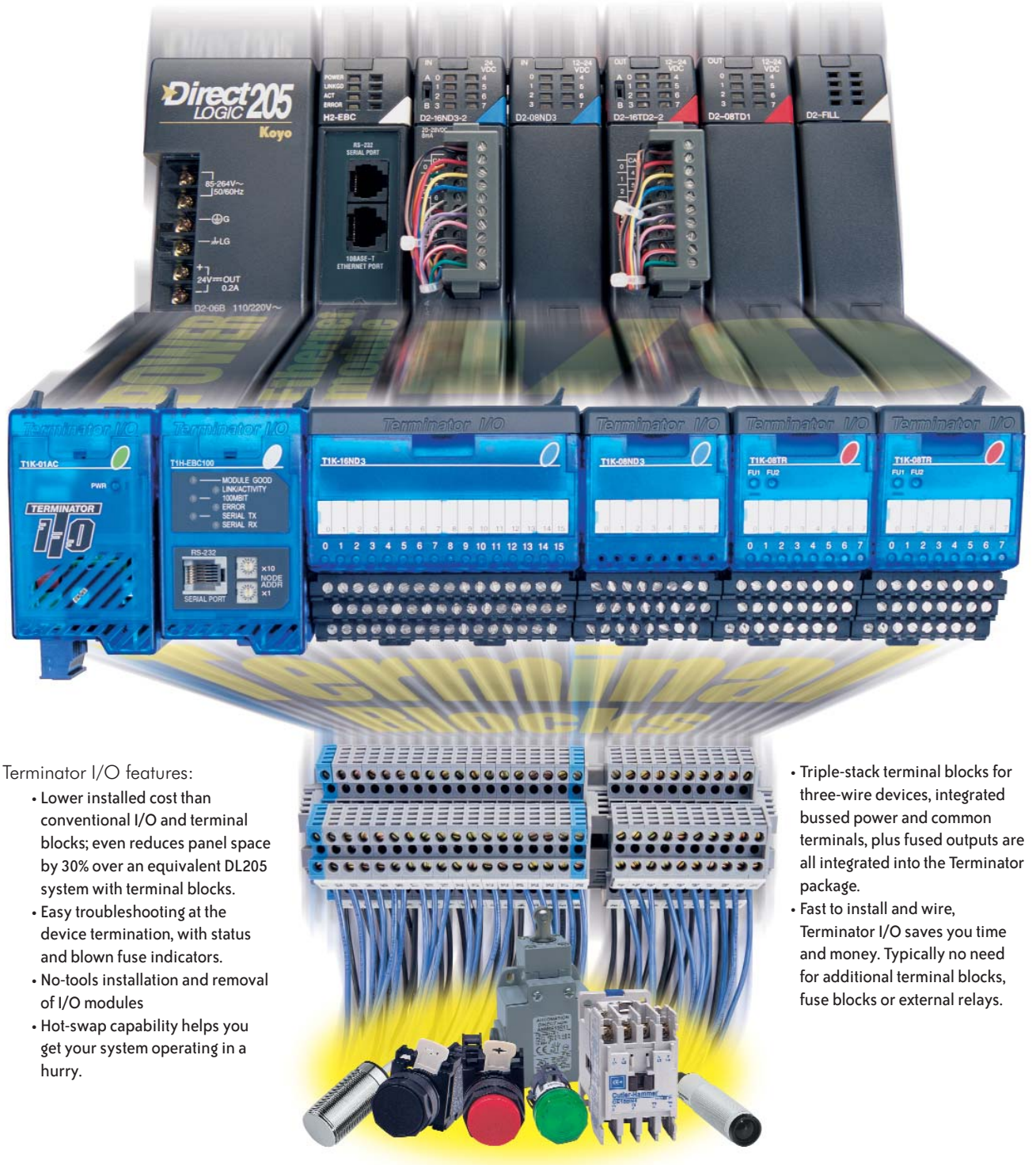
Terminator I/O includes specialty modules like our 16-channel RTD temperature module (T1F-16RTD) and the counter module (T1H-CTRIO)

Add additional power module where needed

It's All Included With Terminator I/O

Terminator I/O combines all the features of terminal blocks and I/O modules into one convenient package. We took the proven I/O technology of the *Direct*LOGIC DL205/405 PLC families and combined it with a modular terminal block base to create the most practical I/O solution for any automation project.





Terminator I/O features:

- Lower installed cost than conventional I/O and terminal blocks; even reduces panel space by 30% over an equivalent DL205 system with terminal blocks.
- Easy troubleshooting at the device termination, with status and blown fuse indicators.
- No-tools installation and removal of I/O modules
- Hot-swap capability helps you get your system operating in a hurry.
- Triple-stack terminal blocks for three-wire devices, integrated bussed power and common terminals, plus fused outputs are all integrated into the Terminator package.
- Fast to install and wire, Terminator I/O saves you time and money. Typically no need for additional terminal blocks, fuse blocks or external relays.

Pick Your Pieces and Drop 'em In

Two sizes of terminal bases accommodate all I/O modules

- Half-size bases for modules with up to 8 points (T1K-08B, T1K-08B-1)
- Full size bases for modules with up to 16 points (T1K-16B, T1K-16B-1)
- Triple-stack terminal blocks standard, easy to connect multi-wire devices
- Same bases for all I/O modules - AC, DC, and analog
- Screw and spring clamp terminals

Power supplies - freedom of choice, freedom to expand

- DC power supplies (T1K-01DC), AC versions also (T1K-01AC)
- AC supplies include 24 VDC auxiliary supply for convenient field device wiring
- Need more power for high current devices or modules? Just add another power supply before the next modules in the system!

8-channel I/O

16-channel I/O

Four types of 8-channel I/O
Four types of 16-channel I/O
Two types of combination I/O
Thermocouple and RTD modules

Analog modules at a super low price per channel

- 8-channel input modules

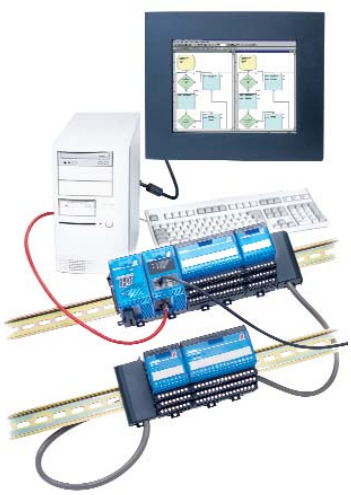
- 16-channel output modules

- 0-20mA/4-20 mA and unipolar/bipolar voltage models available
- 14-channel thermocouple module

  (T1F-14THM)
- Hot-swap analog modules for fast system maintenance

Specialty modules

- **Counter** module with pulse out (T1H-CTRIO)



Local expansion - up to two additional rows

- Full backplane expansion through cables
- Connect up to 16 modules across three total rows by plugging expansion cables from the side of one module to the side of the next. The system automatically recognizes the I/O.
- Optional cable that includes 24 VDC pins maximizes your power supply capability

Network interface modules for your favorite fieldbus

- Ethernet - the "common sense network", 10Base-T , 10/100Base-T , DeviceNet, Modbus, Koyo remote I/O, even Profibus
  --
- All network modules include on-board RS-232 serial port with varied support for operator interfaces, bar code readers, printers or other serial devices (check specific network adapter specifications)

T1H-EBC100
Ethernet

T1H-EBC
Ethernet

T1H-PBC
PROFIBUS™

T1K-DEVNETS
DeviceNet™

T1K-MODBUS
Modbus®

T1K-RSSS
Koyo remote I/O

Discrete I/O with the features you need

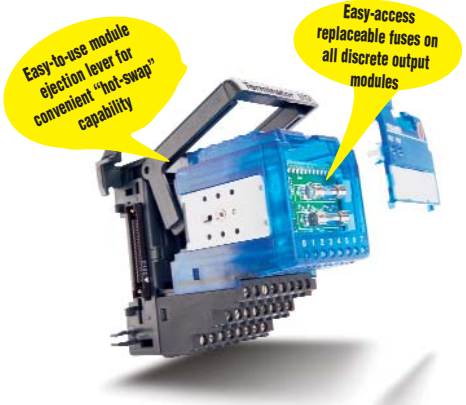
8-point I/O

16-point I/O

- 8-point input modules

- 16-point I/O

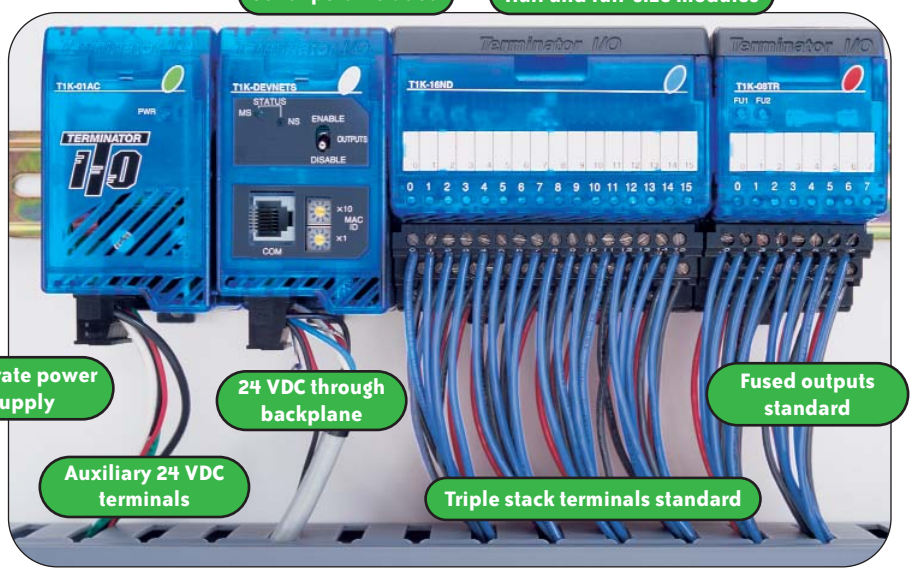
- All DC input modules are sink/source jumper configurable
- Diagnostic LEDs for blown fuse and 24 VDC power on applicable modules
- Hot-swap capability makes troubleshooting easy



We tried to think of everything to make your installation easier.

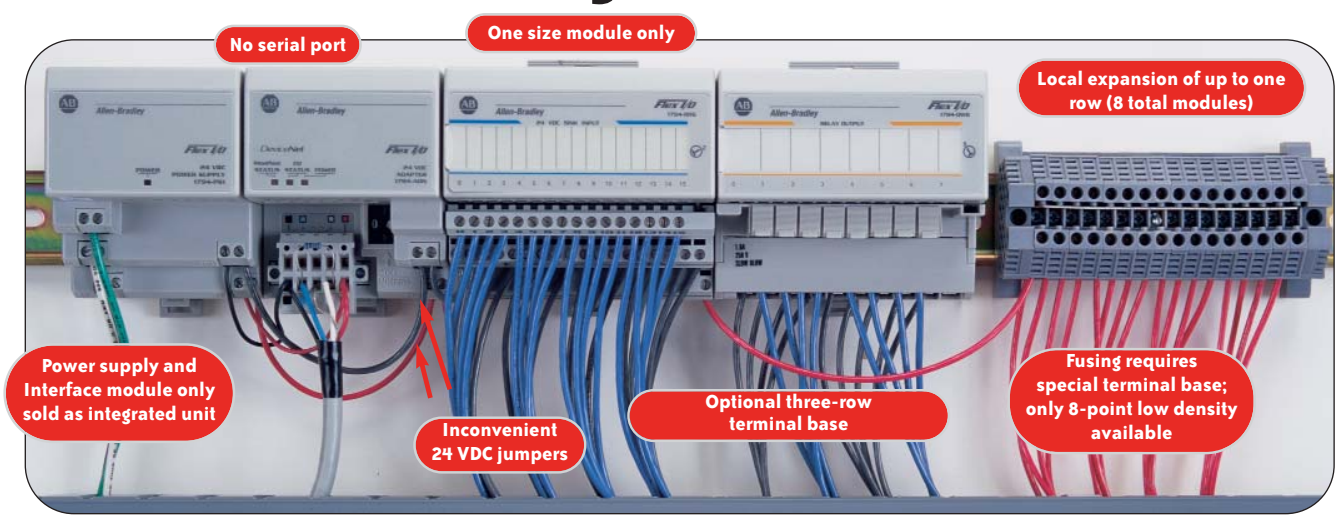
When wiring a Terminator I/O system, you'll see that the little extras make a big difference. Features like **versatile half and full-size I/O modules**, standard **triple-stack terminal bases** for all I/O modules, and **bussed 24 VDC power through the backplane** (for DC input devices) will make your installation quicker and cleaner than any comparable I/O system. Other features include an **RS-232 serial port on selected network interface modules** and **replaceable fuses** integrated into all discrete output modules. Try to find that on Allen-Bradley's Flex I/O!

AutomationDirect's TERMINATOR I/O



VS.

Allen-Bradley Flex I/O®



Just a few applications where Terminator I/O fits

PLC systems

Terminator I/O, with its variety of DC and AC discrete, analog, analog-combination and specialty modules, fills the need for distributed I/O in any size PLC system. An Ethernet Remote Master (H2-ERM or H4-ERM) from a DL205 or DL405 series PLC, paired with an Ethernet Base Controller (T1H-EBC(-100)) at remote I/O locations can supply you with up to a maximum of sixteen Terminator I/O nodes per Ethernet Remote Master channel. With hot-swappable modules and each node capable of handling hundreds of I/O points, Terminator I/O increases the capability of the PLC system you're already using, at a price that won't push the budget of your project.

Use the E-SW050U Ethernet Switch for deterministic Ethernet control for your application.

PLC systems

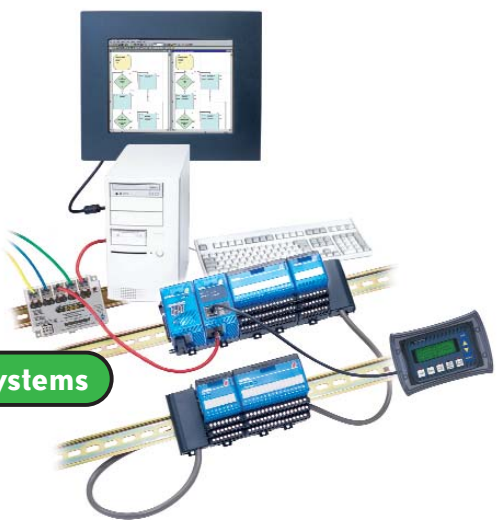
SCADA systems

Terminator I/O can provide great low-cost I/O for your SCADA (Statistical Control and Data Acquisition) system. For example, a PC running KEP*Direct* Ethernet I/O OPC Server can monitor and control your distributed I/O via an Ethernet Base Controller (T1H-EBC(-100)). Terminator I/O is also offered with DeviceNet, Modbus and Profibus interfaces. Terminator I/O's convenient, modular terminal bases are perfect for your remote I/O locations. Terminator I/O's slim profile and optional panel or DIN-rail mounting make it easy to install and wire the perfect combination of I/O in small junction boxes or other tight spaces close to your field devices.

SCADA Systems

PC-based control systems

Terminator I/O is the clear choice for PC-based control I/O systems. Choose a network interface module and the I/O modules to meet your application's needs. Terminator I/O is compatible with several PC-based control packages, including Think & Do Studio and Think & Do Live! flowchart-based control software. Choose Think & Do Live!, add one of our industrial monitors to your PC, and you have a PC control system that is Ethernet-ready to connect to Terminator I/O.



PC-based control systems

WinPLC systems

Terminator I/O is the perfect remote I/O complement to our technology-leading WinPLC Windows CE-based controllers. Simply install an H2-ERM (Ethernet Remote Master) module into your DL205 WinPLC system and you can control up to sixteen modules (*NOTE: one EBC per ERM*) of remotely located Terminator I/O. The 10/100 MB Ethernet speed ensures fast I/O updates over long distances, and convenient standard RJ45 receptacles make system cabling simple with off-the-shelf parts.

Hybrid control system

Terminator I/O

How it works:

Terminator I/O combines all the features of terminal blocks and I/O modules into one convenient package.

Achieve maximum system flexibility with our DIN rail mountable Terminator I/O system. Shorten wiring runs by locating I/O near field devices. Add modules in the future without buying new bases.

Our removable I/O modules connect internally to three-tier spring clamps or screw-type terminal blocks.

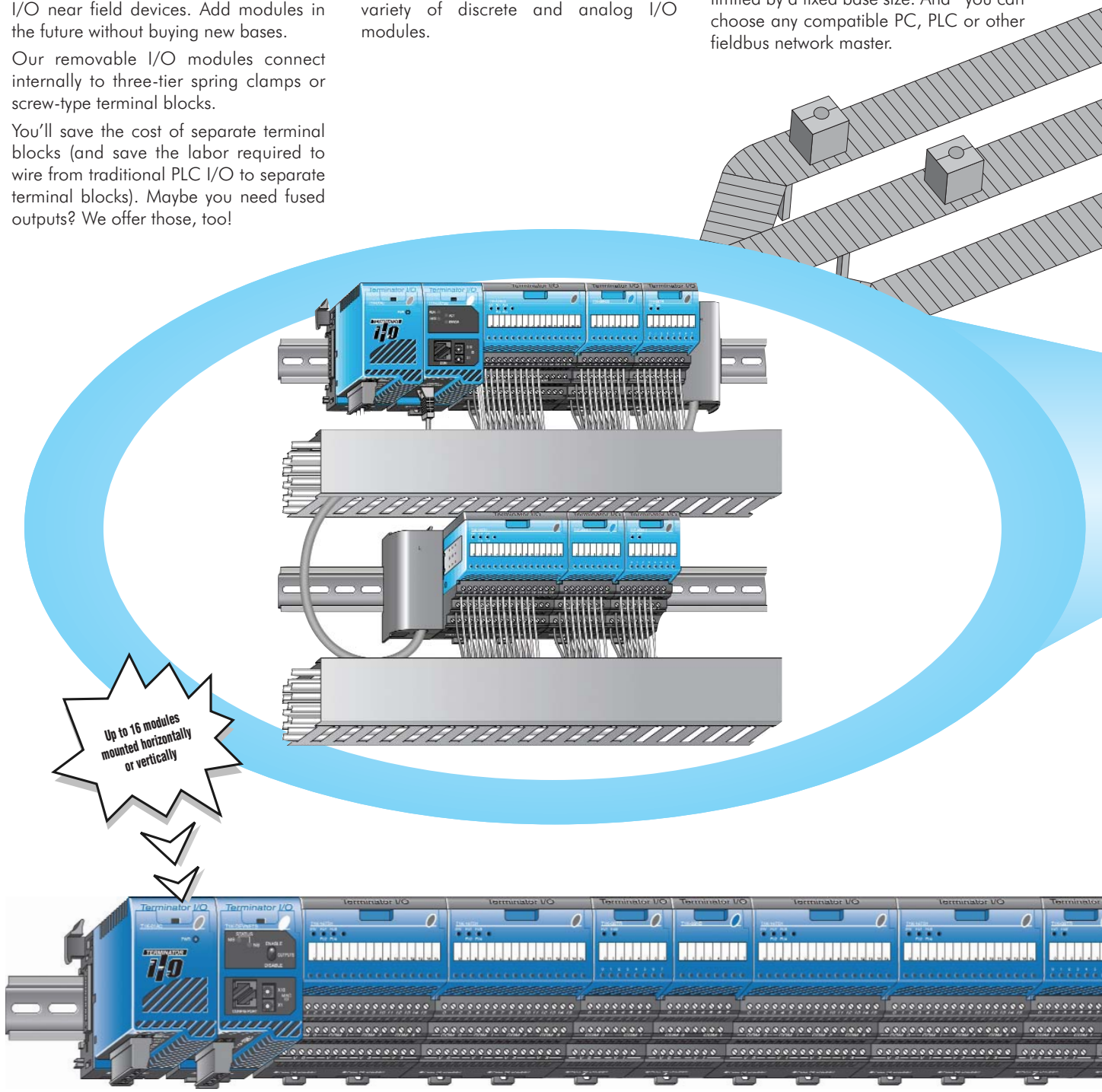
You'll save the cost of separate terminal blocks (and save the labor required to wire from traditional PLC I/O to separate terminal blocks). Maybe you need fused outputs? We offer those, too!

One of the best features of Terminator I/O is its connectivity. We offer a choice of five plug-compatible network interface modules to connect you to your choice of network.

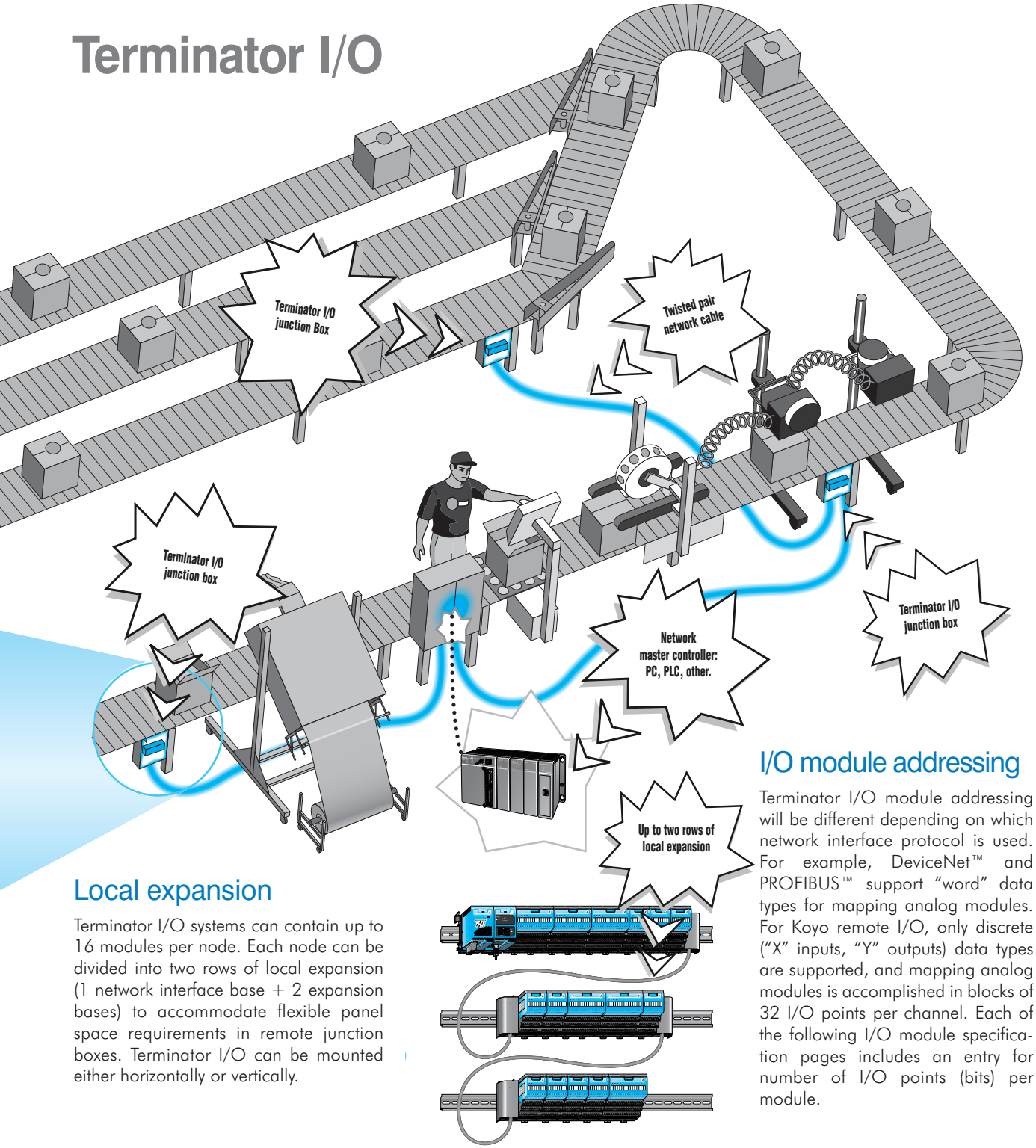
Each system needs at least one AC or DC power supply, but you can add more power if you need it. And, we offer a wide variety of discrete and analog I/O modules.

Building a system from Terminator I/O components

With Terminator I/O, you mount just the I/O modules you need to your DIN rail (or you can panel-mount them). You are not limited by a fixed base size. And you can choose any compatible PC, PLC or other fieldbus network master.



Terminator I/O

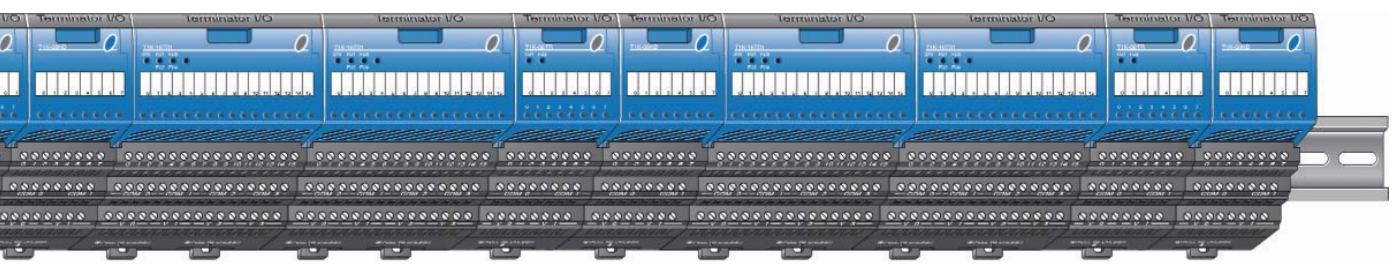


Local expansion

Terminator I/O systems can contain up to 16 modules per node. Each node can be divided into two rows of local expansion (1 network interface base + 2 expansion bases) to accommodate flexible panel space requirements in remote junction boxes. Terminator I/O can be mounted either horizontally or vertically.

I/O module addressing

Terminator I/O module addressing will be different depending on which network interface protocol is used. For example, DeviceNet™ and PROFIBUS™ support "word" data types for mapping analog modules. For Koyo remote I/O, only discrete ("X" inputs, "Y" outputs) data types are supported, and mapping analog modules is accomplished in blocks of 32 I/O points per channel. Each of the following I/O module specification pages includes an entry for number of I/O points (bits) per module.



Dimensions and Installation

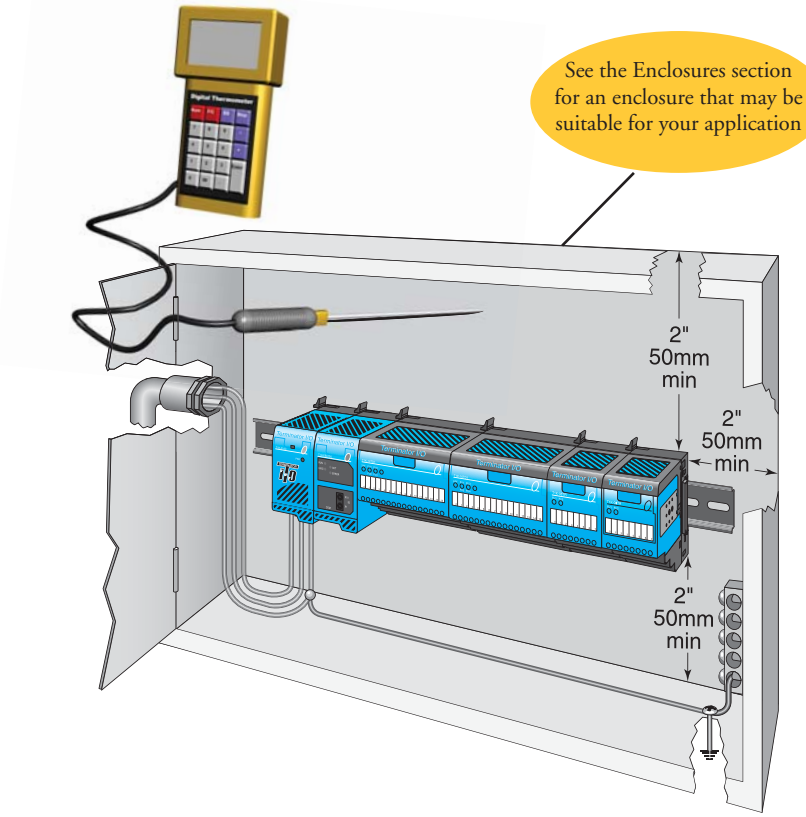
It is important to understand the installation requirements for your Terminator I/O system. This will ensure that the Terminator I/O products work within their environmental and electrical limits.

Plan for safety

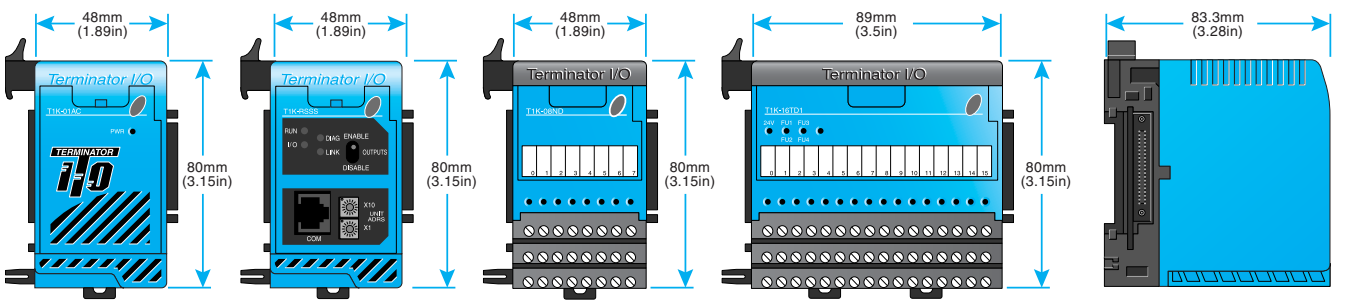
This catalog should never be used as a replacement for the technical data sheet that comes with the products or the T1K-INST-M Installation and I/O Manual (available online at www.automationdirect.com.) The technical data sheet contains information that must be followed. The system installation should comply with all appropriate electrical codes and standards.

Unit dimensions and mounting orientation

Use the following diagrams to make sure the Terminator I/O system can be installed in your application. Terminator I/O units should be mounted horizontally. To ensure proper airflow for cooling purposes, units should not be mounted upside-down. It is important to check the Terminator I/O dimensions against the conditions required for your application. For example, it is recommended to leave 2" depth for ease of access and cable clearance. However, your distance may be greater or less. Also, check the installation guidelines for the recommended cabinet clearances.



Terminator I/O Environmental Specifications	
Ambient Operating Temperature	32°F to 131°F (0°C to 55°C)
Storage Temperature	-4°F to 158°F (-20°C to 70°C)
Ambient Humidity	5% to 95% (Non-condensing)
Atmosphere	No corrosive gases. The level of environmental pollution = 2 (UL 840)
Vibration Resistance	MIL STD 810C, Method 514.2
Shock Resistance	MIL STD 810C, Method 516.2
Voltage Withstand (Dielectric)	1500 VAC, 1 minute
Insulation Resistance	500 VDC, 10 MΩ
Noise Immunity	NEMA ICS3-304 Impulse noise 1µs, 1000 V FCC class A RFI (144 MHz, 430 MHz 10 W, 10 cm)
Agency Approvals	UL, CE, FCC class A, NEC Class 1 Division 2



Power Supply | Network Interface Module | Half-size I/O Module with Base | Full-size I/O Module with Base | System Depth

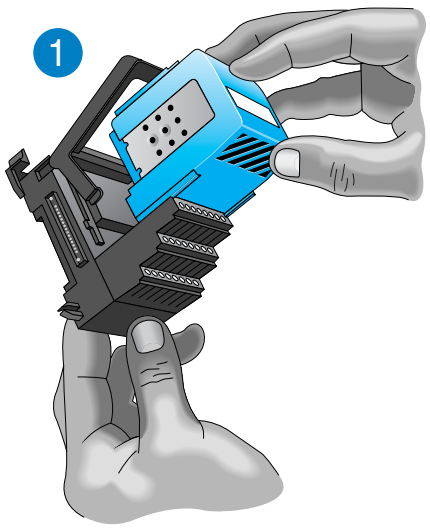
I/O Module Installation

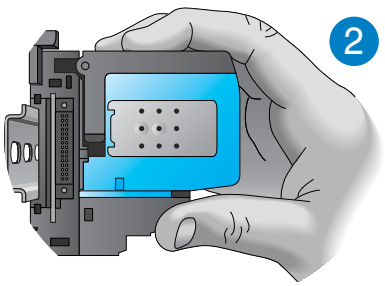
I/O module installation

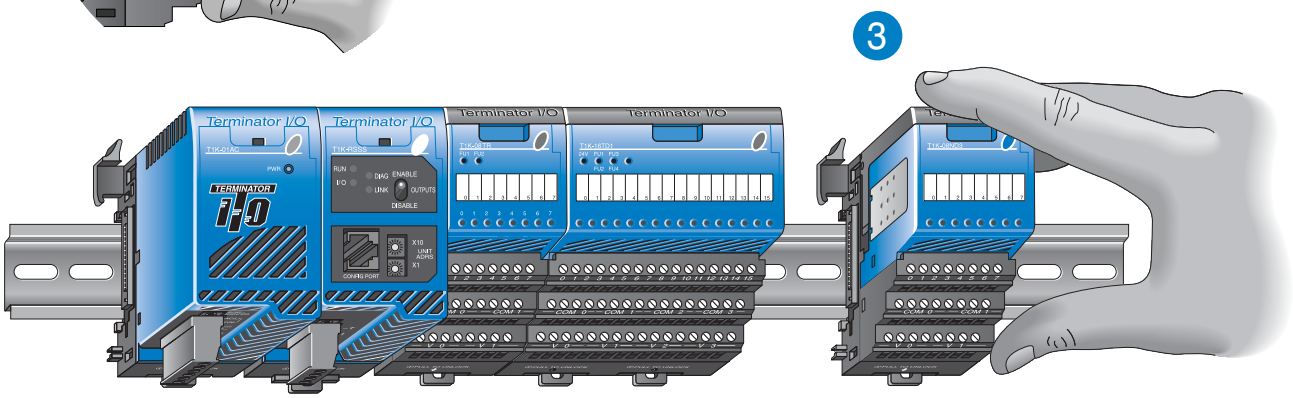
Terminator I/O modules feature separate terminal bases for easy installation.

To install I/O modules:

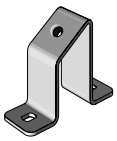
1. Slide the module into its terminal base (until it clicks into position)
2. Hook upper DIN rail tabs over the top of DIN rail, and press the assembly firmly onto the DIN rail.
3. Slide the module along the DIN rail until it engages with the adjacent module.

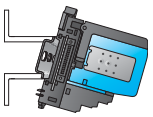




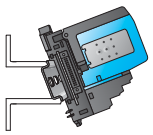


DN-ASB-1 angled mounting bracket





Great for mounting in upper locations

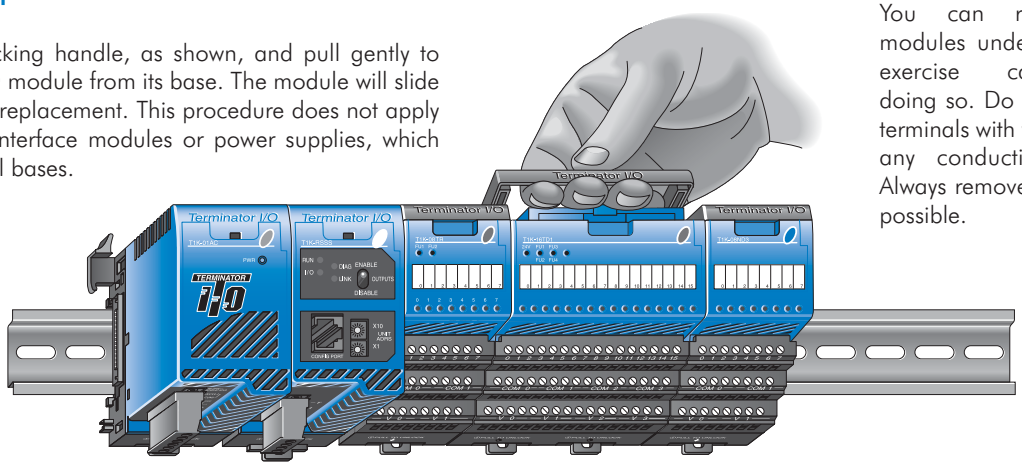


Great for mounting in lower locations

Optional angled support bracket raises and tilts the mounting rail for easier access and wiring. Use with 35 mm DIN rail. See the Connection Systems in this catalog for details.

Removing I/O modules is a snap

Grip the locking handle, as shown, and pull gently to eject the I/O module from its base. The module will slide out for easy replacement. This procedure does not apply to network interface modules or power supplies, which have integral bases.



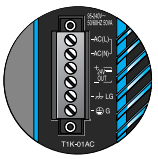
Hot-swappable I/O modules

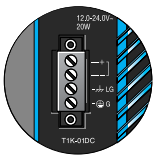
You can remove I/O modules under power, but exercise caution while doing so. Do not touch the terminals with your hands or any conductive material. Always remove power when possible.

Power Supplies and Power Requirements

Power supplies

The Terminator I/O product line offers two power supply options: AC or DC. The power supplies are always positioned to the left of the modules to which they supply power. Consult the system configuration examples and the power budgeting example for more information on positioning power supplies.





Power supply specifications

Power Supply Specifications		T1K-01AC <--->	T1K-01DC <--->
Input Voltage Range		110/220 VAC	12/24 VDC
Input Frequency		50/60 Hz	N/A
Maximum Power		50 VA	30 W
Max. Inrush Current		20 A	10 A
Insulation Resistance		> 10 MΩ @ 500 VDC	
Voltage Withstand		1 min. @ 1500 VAC between primary, secondary and field ground	
5VDC PWR	*Voltage*	5.25 VDC	5.25 VDC
	Current Rating	2000 mA max (see current option note below)	2000 mA max
	Ripple	5% max.	5% max.
24VDC PWR	*Voltage*	24 VDC	N/A
	Current Rating	300 mA max. (see current option note below)	N/A
	Ripple	10% max.	N/A
Fuse		1 (primary), not replaceable	
Note: 500 mA @ 24 VDC can be achieved by lowering the 5VDC from 2000 mA to 1500 mA .			

Power requirements

Module	5VDC	24VDC
Interface Modules		
T1H-EBC	350	0
T1H-EBC100	300	0
T1H-PBC	530	0
T1K-DEVNETS	250	45
T1K-RSSS	250	0
T1K-MODBUS	300	0
DC Input Modules		
T1K-08ND3	35	0
T1K-16ND3	70	0
AC Input Modules		
T1K-08NA-1	35	0
T1K-16NA-1	70	0

Module	5VDC	24VDC
DC Output Modules		
T1H-08TDS	200	0
T1K-08TD1	100	200*
T1K-16TD1	200	400*
T1K-08TD2-1	200	0
T1K-16TD2-1	200	0
AC Output Modules		
T1K-08TA	250	0
T1K-16TA	450	0
T1K-08TAS	300	0
Relay Output Modules		
T1K-08TR	350	0
T1K-16TR	700	0
T1K-08TRS	400	0
Specialty Modules		
T1H-CTRIO	400	0

* Use either internal or external source for 24VDC

Module	5VDC	24VDC
Analog Input Modules		
T1F-08AD-1	75	50*
T1F-08AD-2	75	50*
T1F-16AD-1	75	50*
T1F-16AD-2	75	50*
T1F-14THM	60	70*
T1F-16RTD	150	0
Analog Output Modules		
T1F-08DA-1	75	75*
T1F-08DA-2	75	75*
T1F-16DA-1	75	150*
T1F-16DA-2	75	150*
Combination Analog Modules		
T1F-8AD4DA-1	75	60*
T1F-8AD4DA-2	75	70*

* Use either internal or external source for 24VDC

Calculating the power budget

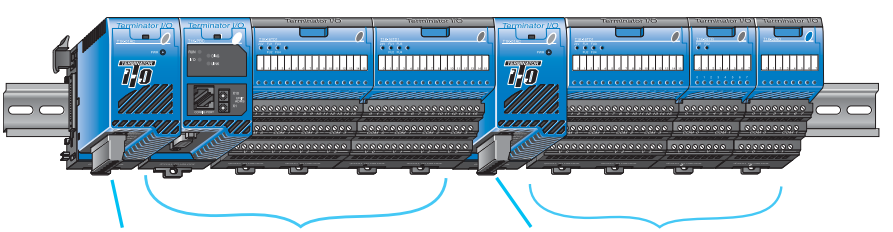
To calculate the power budget, read the available power (current rating) from the Power Supply Specifications table and subtract the power consumed by each module to the right of the power supply. Do not include modules to the right of an additional power supply.

Adding additional power supplies

Each power supply furnishes power only to the network interface and I/O modules to its right. Inserting a second power supply closes the power loop for the power supply to the left, while also powering the modules to its right. Perform a power budget calculation for each power supply in the system.

Power Budget Example		
Module	***5VDC***	***24VDC***
T1K-01AC	+2000 mA	+300 mA
T1H-EBC	-350 mA	-0 mA
T1K-16ND3	-70 mA	-0 mA
T1K-16TD2	-200 mA	-0 mA
T1F-08AD-1	-75 mA	-50 mA
Remaining	+1305 mA	+250 mA

Accessories available for Terminator I/O are listed in the Terminator Field I/O section of the Price List



This power supply powers the network interface module and the next two I/O modules

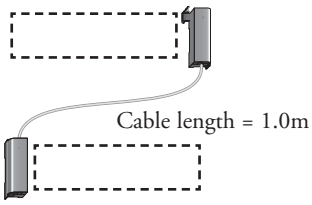
This power supply powers these three I/O modules

Expansion I/O Configurations

Expansion cables

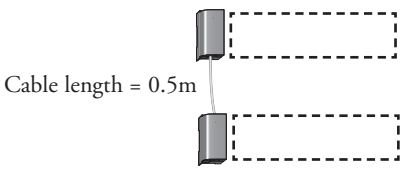
T1K-10CBL <--->
T1K-10CBL-1* <--->
Right side to left side expansion cable

The T1K-10CBL(-1) connects the right side of an I/O base to the left side of the next I/O base. A maximum of two T1K-10CBL(-1) cables can be used per expansion system.



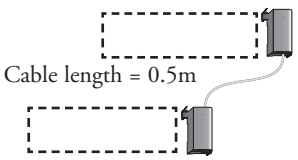
T1K-05CBL-LL <--->
T1K-05CBL-LL-1* <--->
Left side to left side expansion cable

The T1K-05CBL-LL(-1) connects the left side of an I/O base to the left side of the next I/O base. Only one T1K-05CBL-LL (-1) cable can be used per expansion system and must be used with a T1K-05CBL-RR(-1) cable. **This cable cannot be connected to the left side of the network interface base.**



T1K-05CBL-RR <--->
T1K-05CBL-RR-1* <--->
Right side to right side expansion cable

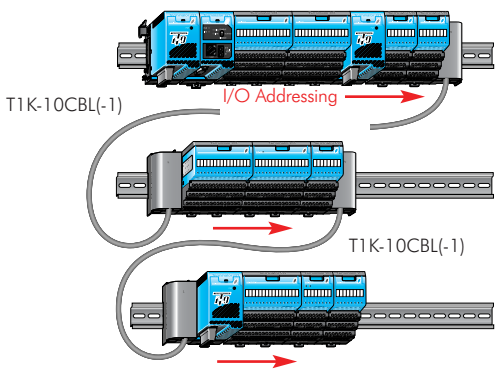
The T1K-05CBL-RR(-1) connects the right side of an I/O base to the right side of the next I/O base. A maximum of one T1K-05CBL-RR(-1) cable can be used per expansion system. **Note: When this cable is used, the expansion I/O assignments are from right to left (reversed).**



***Note:** The (-1) versions of the expansion cables pass 24 VDC through on an isolated wire. (All cables pass the 5 VDC base power.) Any local expansion DC input module configured for "internal power" (current sourcing) must either have a power supply preceding it on the same base or, have a (-1) version cable pass 24 VDC from a power supply on the preceeding base.

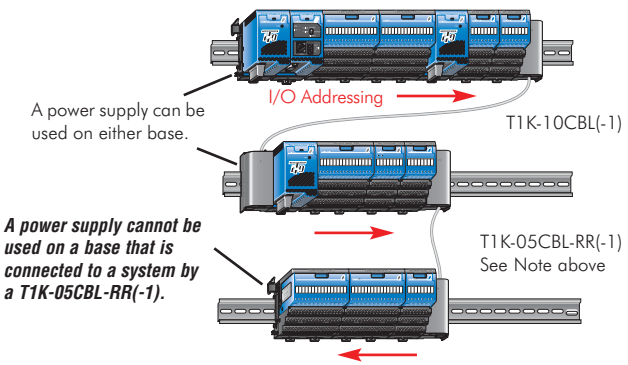
Using two T1K-10CBL expansion cables

In the system below, power supplies can be used anywhere.



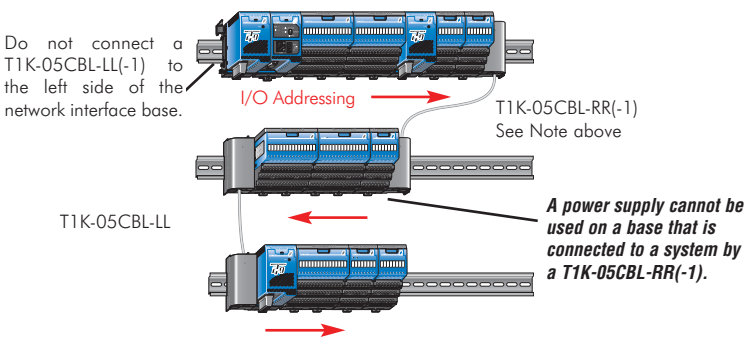
Using T1K-10CBL expansion cable and T1K-05CBL-RR expansion cable

Power supplies can be used anywhere in the first two bases, but not in the last expansion base.



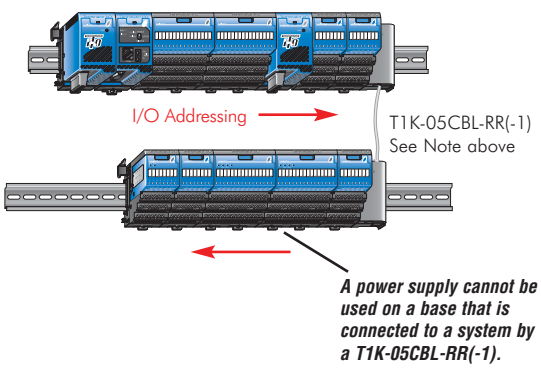
Using T1K-05CBL-RR expansion cable and T1K-05CBL-LL expansion cable

Power supplies can be used anywhere in the first and third bases, but not in the second base.



Using T1K-05CBL-RR expansion cable

Power supplies can be used anywhere in the first base, but not in the second base.



Field Device Wiring and Power Options

Terminal base specifications

Terminator I/O terminal bases are available in screw clamp and spring clamp versions for both half-size and full-size modules. Hot stamp silkscreen labeling is used for numbering I/O points, commons, and all power terminals.

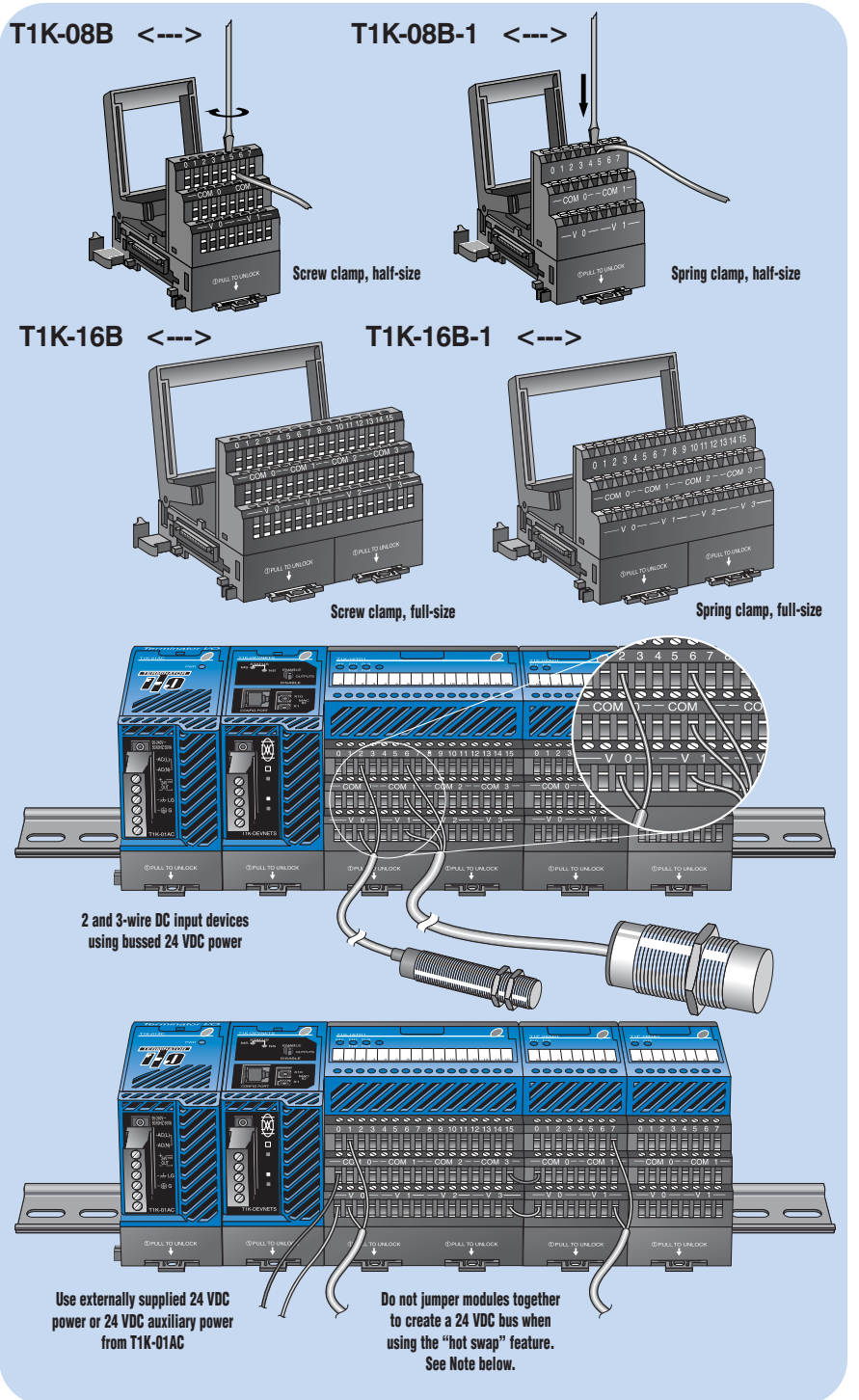
Terminal Base Specifications		
Terminal Type	Screw type	Spring clamp
Recommended Torque	1.77-3.54 lb-in (0.2 - 0.4 Nm)	n/a
Wire Gauge	Solid: 25-12 AWG Stranded: 26-12 AWG	Solid: 25-14 AWG Stranded: 26-14 AWG

Field device wiring options

Power your DC input devices from the integrated 24 VDC power supply bus. T1K-08ND3 and T1K-16ND3 DC input modules include jumpers for selecting the internal 24 VDC power supply available for 2- and 3-wire field devices. Clearly labeled triple stack terminals make it easy to wire 2- and 3-wire devices ensuring clean wiring with only one wire per termination.

External user supplied 24 VDC power, or auxiliary 24 VDC terminals from T1K-01AC, can be easily applied directly to one end of the terminal rows and jumpered across each base in the system.

This is a convenient solution for powering analog I/O and discrete DC output devices whose modules do not have direct access to the internal bussed 24 VDC. If current consumption increases, simply add additional T1K-01AC power supplies into the system.



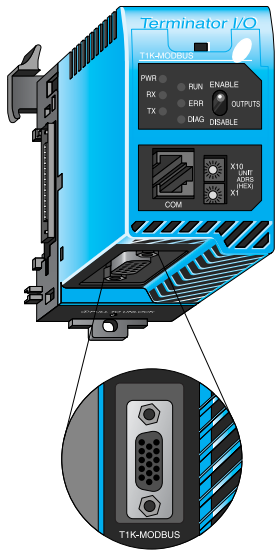
Hot-swap feature

The hot-swap feature allows Terminator I/O modules to be replaced while system power is on. Be careful not to touch the terminals with your hands or other conductive material to avoid the risk of personal injury or equipment damage. Always remove power if it is equally convenient to do so.

Note: Before hot-swapping analog or DC output modules in a Terminator I/O system, make sure that each of the analog and DC output module's 24 VDC and 0 VDC base terminals are wired directly to the external power supply individually. If the external 24 VDC and 0 VDC is jumpered from base to base in a daisy chain fashion, and an analog or DC output module is removed from its base, the risk of disconnecting the external 24 VDC and 0 VDC to the subsequent I/O modules exists.

Modbus RTU Slave

T1K-MODBUS <--->



The Terminator I/O Modbus network interface module allows you to connect I/O as a slave station on a Modbus RTU network. The T1K-MODBUS can communicate with any Modbus RTU network master using high-level Modbus commands.

*Direct*LOGIC Modbus communications

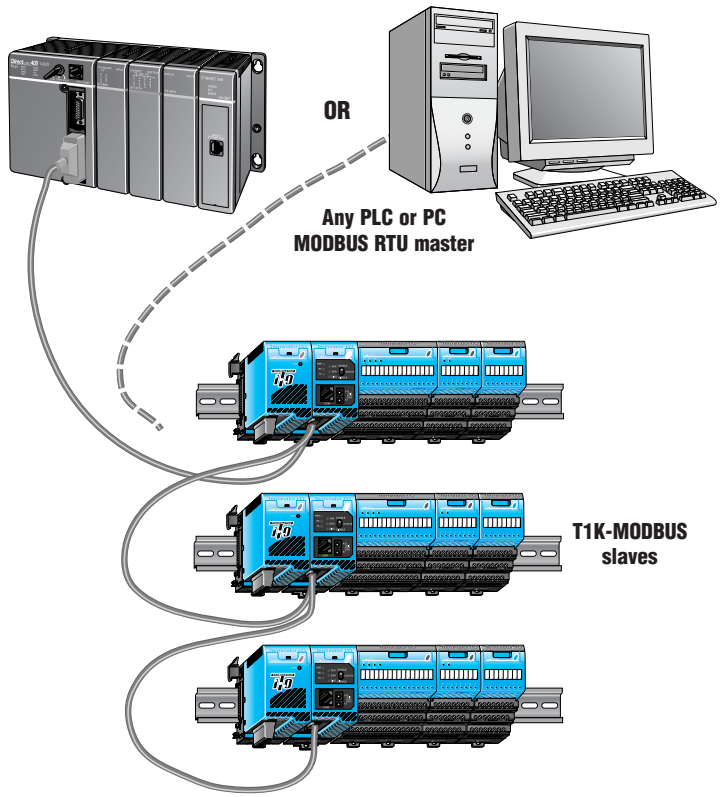
Some of our *Direct*LOGIC PLCs can be used as Modbus masters, directly through a communication port on the CPU. *(Consult the PLC section of this catalog for more information.)*

Network configuration options

You can configure a simple point-to-point network or create a multidrop network using the RS-232, RS-422/485 HD-15 Modbus port. The T1K-MODBUS has two rotary switches that can be set to designate the module's slave address. Set the rotary switches to give each slave a unique address in a range from 1-F7 hex (1-247 decimal). The T1K-MODBUS also has an auxiliary RJ12 RS-232 serial port that can be used to configure the Modbus port with the T1K-MODBUS Setup Tool.

Asynchronous communications

In most applications, the Modbus master polls the slaves individually (T1K-MODBUS) to read/write each slave's I/O. The communication between the Modbus master and slave will often be asynchronous to the master CPU scan. For this reason, applications should be limited to those that do not require the I/O points to update every master CPU scan.



Specifications		
Modbus Port ***Cable Lengths and Baud Rates***	***RS-232***	15 m (50 ft.): 300, 600, 1200, 2400, 4800, 9600; 19.2 K, 38.4 K baud
	RS-422/485	1000 m (3300 ft): 300, 600, 1200, 2400, 4800, 9600; 19.2 K, 38.4 K baud
Max. I/O Points per Controller		Discrete: inputs: 1024, outputs: 1024; Analog: inputs: 64 channels, outputs: 64 channels
Recommended Cable		Belden 9729 or equivalent (RS-422)
Terminal Type		15-pin female high-density (VGA style) D-sub connector
RJ12 Serial Port		RS-232; 9600/19200 baud; supports K-Sequence and ASCII (Use to configure Modbus port using T1K-MODBUS setup tool)
Base Power Requirement		250 mA @ 5 VDC

Ethernet Networking

T1H-EBC <---> T1H-EBC100 <--->

The T1H-EBC(100) modules provide a low-cost, high-performance Ethernet link between Terminator I/O and your PC-based control or WinPLC/ DL205/DL405 CPUs using the H*-ERM module for remote I/O.

These interface modules support industry standard 10Base-T or 100Base-T communications.

Supported protocols

The Terminator T1H-EBC supports UDP/IP and IPX at 10 Mbps maximum. The T1H-EBC100 supports TCP/IP, UDP/IP, IPX and Modbus TCP at 100 Mbps maximum.

Network masters

Network masters include the DL205, DL405 *Direct*LOGIC PLCs and WinPLCs using the Ethernet Remote Master module (ERM), and PCs using PC-based control software that includes embedded Ethernet I/O drivers.

T1H-EBC as H*-ERM slave

When using a *Direct*LOGIC CPU with an ERM module as the network master, the T1H-EBC(100) slave will provide faster analog I/O update times than a *Direct*LOGIC CPU system with a T1K-RSSS slave system. The ERM/EBC system can also support a much higher analog I/O count than the T1K-RSSS remote I/O system.

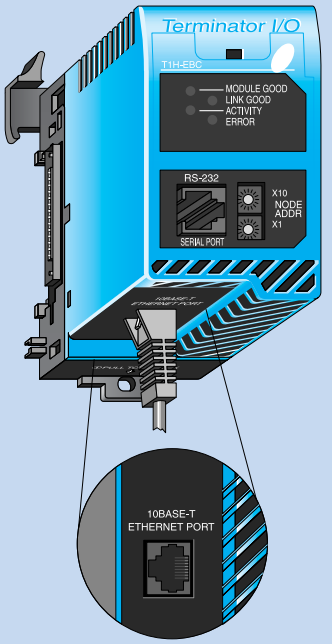
Inexpensive cables and connecting devices

The Terminator EBC modules are made with industry standard RJ45 connections for easy networking. Off-the-shelf Ethernet hubs and repeaters make configuring a network a breeze.

No DIP-switch settings

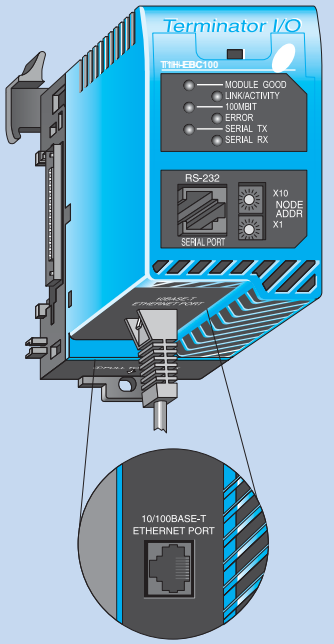
All addressing and setup features are configurable through the software configuration tool. All I/O data are passed into the EBC buffer and communicated as a block almost instantaneously to the host device.

T1H-EBC



- Save money on your Terminator I/O system when compared with competitive I/O
- Virtually unlimited number of I/O points (up to sixteen modules per EBC system)
- Deterministic I/O updates on dedicated networks

T1H-EBC100



- Use off-the-shelf networking components to connect to your existing network
- Fast I/O updates of <1 ms per base
- On-board serial port for operator panel or ASCII devices

Specifications	T1H-EBC	T1H-EBC100
Communications	10Base-T Ethernet	100Base-T Ethernet
Data Transfer Rate	10 Mbps	10/100 Mbps
Link Distance	100 meters (328 ft.)	
Ethernet Port	RJ45	
Ethernet Protocols	UDP/IP, IPX	TCP/IP, UDP/IP, IPX, Modbus TCP
Power Consumption	350 mA	300 mA
Manufacturer	Host Automation Products, L.L.C.	
RJ12 Serial Port [1]	K-sequence, ASCII	K-sequence, ASCII, Modbus RTU

[1] At this time, the serial port is unavailable when these modules are used as slave devices to the H2-ERM or H4-ERM modules.

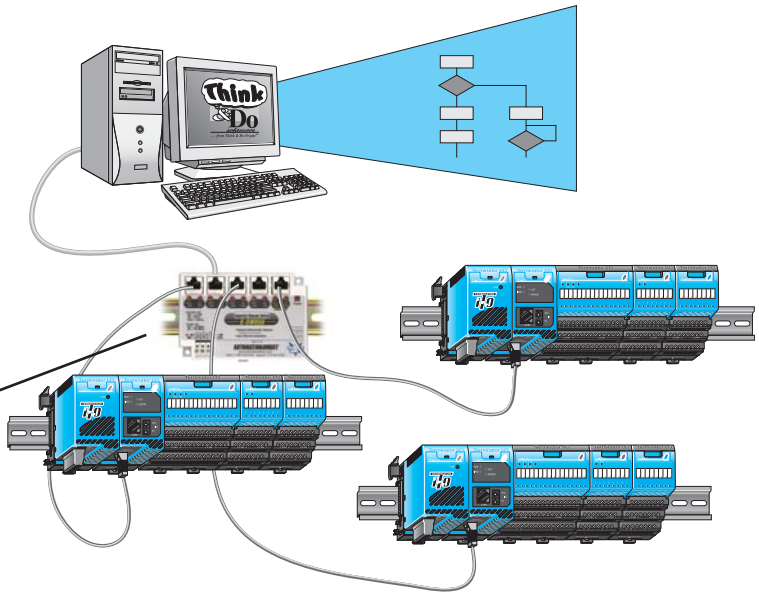
Adding I/O modules

The T1H-EBC(100) supports the full lineup of Terminator I/O discrete and analog modules.

Ethernet Networking

Off-the-shelf system solutions

You can purchase PC-based control software to connect to our T1H-EBC(100) Ethernet Base Controller. PC-based control packages are equipped with compatible I/O device drivers, program development tools, and run-time environments. See the PC-based Control section of this catalog for a single-source integrated PC-based control solution that ships with everything you need to make your PC into an industrial controller.



E-SW05-U Ethernet Switch (See the Communications Products section of this catalog for details).

Vendor	Product	Web Address
AutomationDirect	KEP*Direct* EBC I/O Server	www.automationdirect.com
Phoenix Contact	Think and Do Live! Think and Do Studio	www.phoenixcon.com/software
KEPWare	KEPServerEX	www.kepware.com
MDSI	Open CNC	www.mdsi2.com

READ I/O

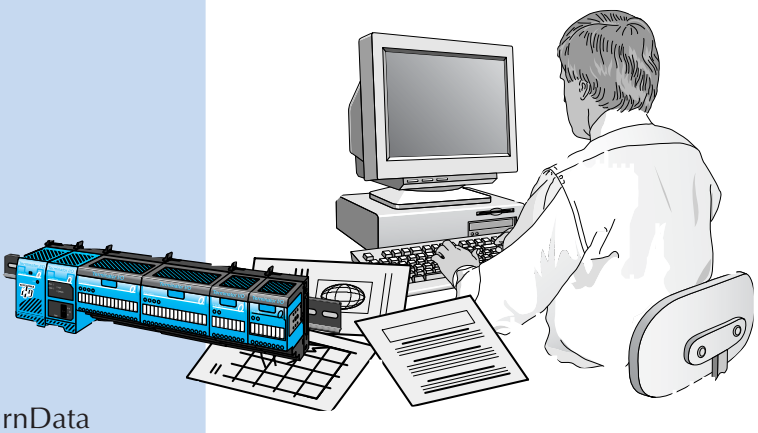
```
int HEIReadIO
        (
        HEIDevice *pDevice,
                Byte *pBuffer,
                WORD BuffSize
        );
```

WRITING I/O

```
int HEIWriteIO
        (
        HEIDevice *pDevice,
                BYTE *pData,
                WORD SizeofData,
                BYTE *pReturnData,
                WORD *pSizeofReturnData
        );
```

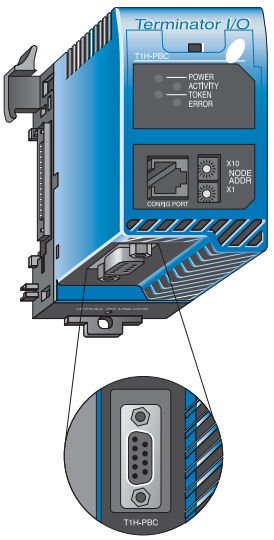
Software developers

For programmers developing custom drivers for our I/O, we offer a free Ethernet Software Development Kit (SDK). The software interface libraries are provided for WIN32, WIN16, and DOS operating systems. The source code is available to developers under a non-disclosure agreement. Visit the technical support link at our Web site for more information.



PROFIBUS™ Slave

T1H-PBC <--->



PROFIBUS™ I/O system overview

If you are using a PROFIBUS™ controller network, the Terminator I/O sub-system will help further reduce the cost of your overall application. The T1H-PBC module allows the micro-modular Terminator I/O sub-system to be linked with a PROFIBUS master controller. PROFIBUS is a control bus that provides a common method to connect automation equipment with devices on a single network. This standard communications media is referred to as PROFIBUS and significantly reduces hard-wiring costs. PROFIBUS provides specifications for information exchanged between nodes, such as controller data associated with low- level device and configuration parameters individually related to system operations.

PROFIBUS allows 32 stations per segment. Segments vary in length depending on the desired transmission speed. The maximum speed is achieved on a segment 100 meters (327 feet) in length. Our PROFIBUS-DP Slave represents a single station. Repeaters also count as stations and are used to extend the network to greater distances. Our PROFIBUS module supports baud rates of 9.6 Kbaud to 12 Mbaud depending on the network length.

Here's how it works:

The T1H-PBC module is a PROFIBUS slave, which can be plugged into the network interface position of the Terminator I/O micro-modular family of I/O bases. This module reports all the identification data, diagnostic information, and parameters that control the module operation. The T1H-PBC module scans and reports all discrete and analog I/O data to a PROFIBUS master. The externally-powered AC Terminator I/O base units contain a 24 VDC power supply for simple wiring of sensors and actuators into the Terminator I/O modules, and for controlling them with a PROFIBUS master. Using our PROFIBUS I/O sub-system will increase installation flexibility as well as save on wiring costs. The T1H-PBC module supports all Terminator discrete and analog I/O modules.

The T1H-PBC also offers the following features:

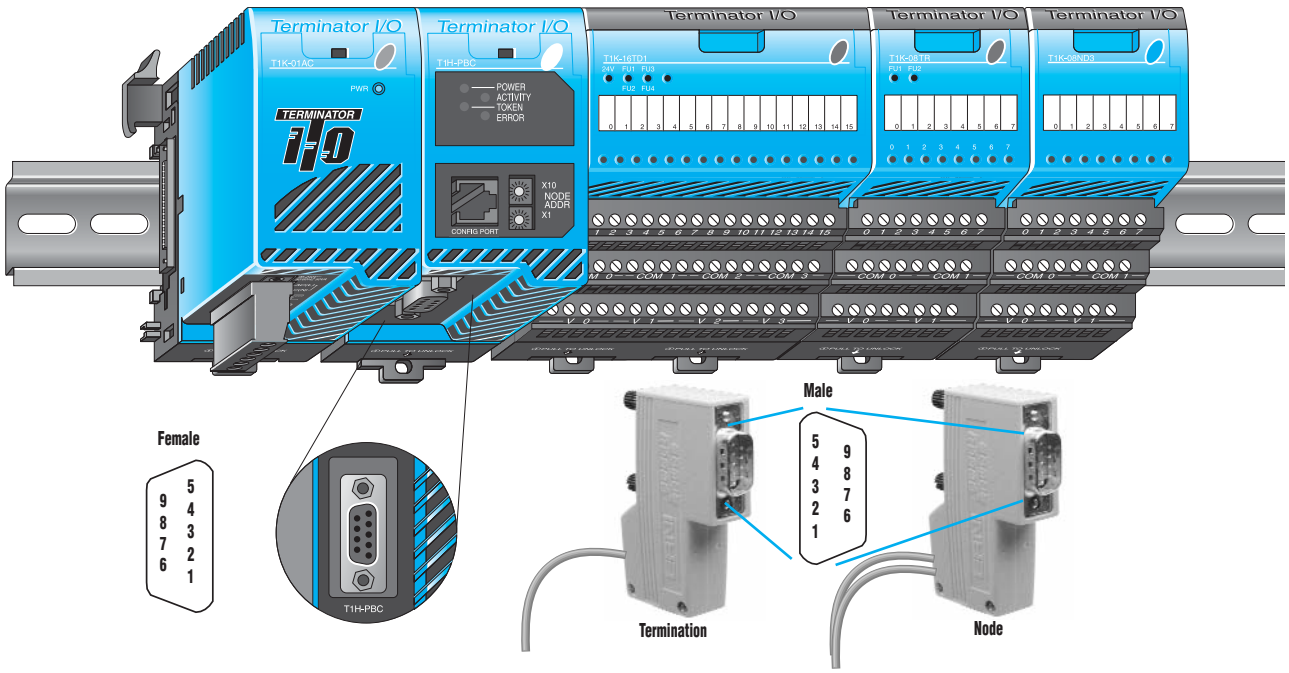
- **Cost-effective:** With a single network for devices, hardwiring costs are reduced.
- **Easy connectivity:** Low-cost installation is easy to implement and maintain.
- **Diagnostics:** The PROFIBUS slave offers advanced error diagnostics not commonly available in traditional systems.
- **High baud rates:** Response time is 10 ms per device
- **LED Indicators:** These provide quick indication of Terminator power and operating mode.

Specifications	
Module Type	PROFIBUS Network Interface Module
Max. Expansion	126 stations, 32 stations per segment, 9 repeaters in a row
Max. I/O Points per Controller	244 Input Bytes (analog or discrete) 244 Output Bytes (analog or discrete) as specified by the PROFIBUS DP Specification
Communications	RS-485 PROFIBUS, PROFIBUS-DP. Baud rate selectable from 9.6 Kbaud to 12 Mbaud.
Module Connectors	PROFIBUS 9-pin D-shell, RJ-12 serial (for firmware update only)
Internal Power Consumption	530 mA maximum at 5 VDC (supplied by base power supply)
Operating Environment	0°C to 60°C (32°F to 140°F), 5% to 95% humidity (non-condensing)
Manufacturer	Host Automation Products, L.L.C.

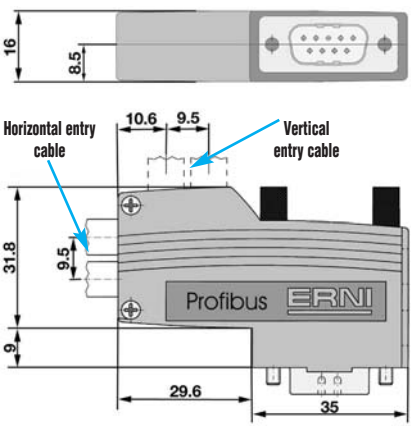
Please Note:

1. ***Terminator I/O PROFIBUS slave network interface module T1H-PBC is a PTO-certified PROFIBUS-compliant slave I/O interface product.***
   See www.profibus.com for more information.
2. ***For use with Think & Do Software, we recommend the SST PROFIBUS PCI Master Card, part number 5136-PFB-PCI. (AutomationDirect does not provide this interface).***
   See www.mysst.com for more information.

PROFIBUS Slave



Baud	Max. Segment Length		Max. Expansion	
	Feet	*Meters*	*Feet*	*Meters*
9.6 Kbps	3278	1000	32786	10000
19.2 Kbps	3278	1000	32786	10000
93.75 Kbps	3278	1000	32786	10000
187.5 Kbps	3278	1000	32786	10000
500 Kbps	1311	400	13114	4000
1.5 Mbps	655	200	6557	2000
3 Mbps	327	100	3270	1000
6 Mbps	327	100	3270	1000
12 Mbps	327	100	3270	1000



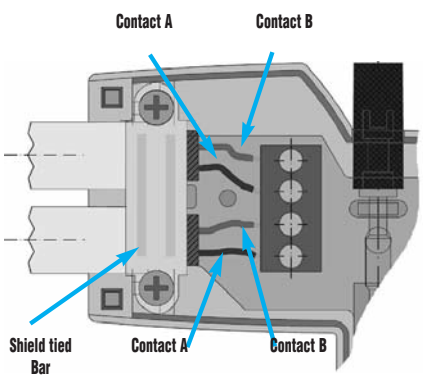
all dimensions in mm

ERNI ER*bic* connectors for PROFIBUS networks

Connectors are available for the PROFIBUS Base Controller. They are available in standard node and standard termination styles with vertical cable entry for Terminator I/O.

Terminator I/O Modules Supported	
Discrete Types	***Analog Types***
8-point DC Input	8-channel Current Input
8-point AC Input	8-channel Voltage Input
16-point DC Input	8-channel Current Output
16-point AC Input	8-channel Voltage Output
8-point DC Output	16-channel Current Input
8-point AC Output	16-channel Voltage Input
16-point DC Output	16-channel Current Output
16-point AC Output	16-channel Voltage Output
8-point Relay Output	
16-point Relay Output	

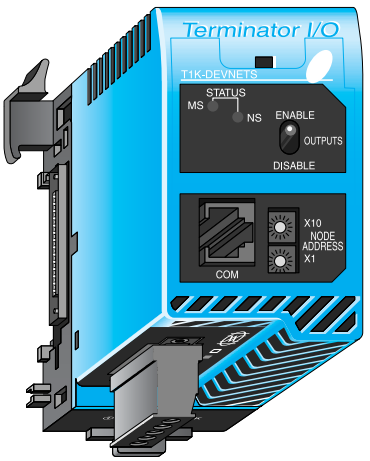
Recommended Cables	
Siemens	6XV1 830 0AH10
Belden	3079A



ERNI ER*bic* Connectors			
Part Number	***Price***	***Description***	***Device***
103658	<--->	PROFIBUS certified standard node vertical connector. 9-pin male D-sub	Terminator I/O T1H-PBC or any PROFIBUS ISA/ PCI Personal Computer Master/Slave Card
103659	<--->	PROFIBUS certified standard termination vertical connector 9-pin male D-sub	Terminator I/O T1H-PBC or any PROFIBUS ISA/ PCI Personal Computer Master/Slave Card

DeviceNet™ Slave

T1K-DEVNETS <--->



DeviceNet™ I/O system overview

If you are already using or planning to implement a DeviceNet™ controller network, our Terminator I/O sub-system will help further reduce the cost of your overall application. We now offer the T1K-DEVNETS (slave) module, which allows our Terminator I/O sub-system to be linked with a DeviceNet master controller. DeviceNet is a low-cost control network that provides a common method to connect on a single network. This advanced communications media and software is referred to as DeviceNet and significantly reduces hardwiring costs. DeviceNet provides specifications for information exchanged between nodes, such as controller data associated with low-level devices and configuration parameters individually related to system operations.

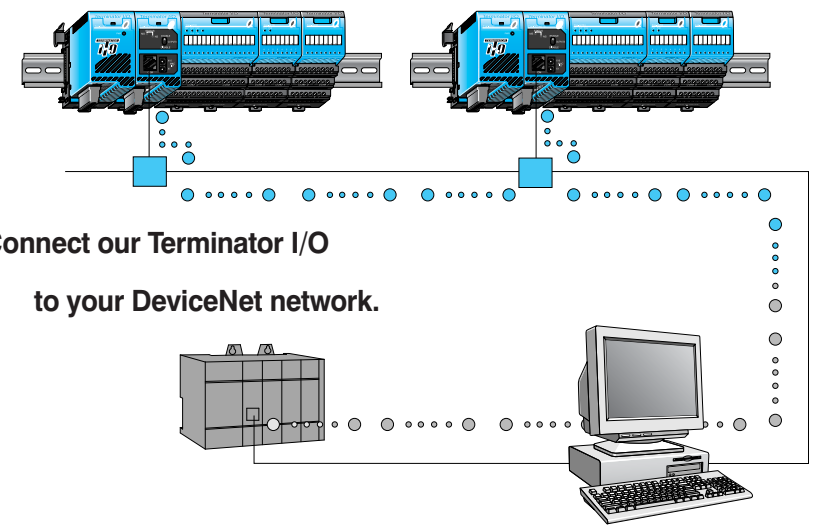
Here's how it works:

The T1K-DEVNETS module is a DeviceNet slave. This module maintains a database with all the identification data, diagnostic information, and parameters that control the module operation. The T1K-DEVNETS module scans and reports all discrete and analog I/O data to a DeviceNet master. The AC power supply provides a 24 VDC output for simple wiring of sensors and actuators into the Terminator I/O modules. Using our Terminator I/O DeviceNet sub-system will increase installation flexibility as well as save on wiring costs. The T1K-DEVNETS module supports all Terminator I/O discrete and analog I/O modules.

The T1K-DEVNETS also offers the following features:

- **Cost-effective**: With a single network for devices, hardwiring costs are reduced.
- **Easy connectivity:** Low-cost four wire installation is easy to implement and maintain.
- **Innovative technology:** Power is integrated into the device wiring.
- **Diagnostics:** The module provides advanced error diagnostics not commonly available in traditional control systems.
- **Highly dependable:** Fast response for demanding applications.
- **LED indicators:** Provide quick indication of Terminator I/O power and operating mode.

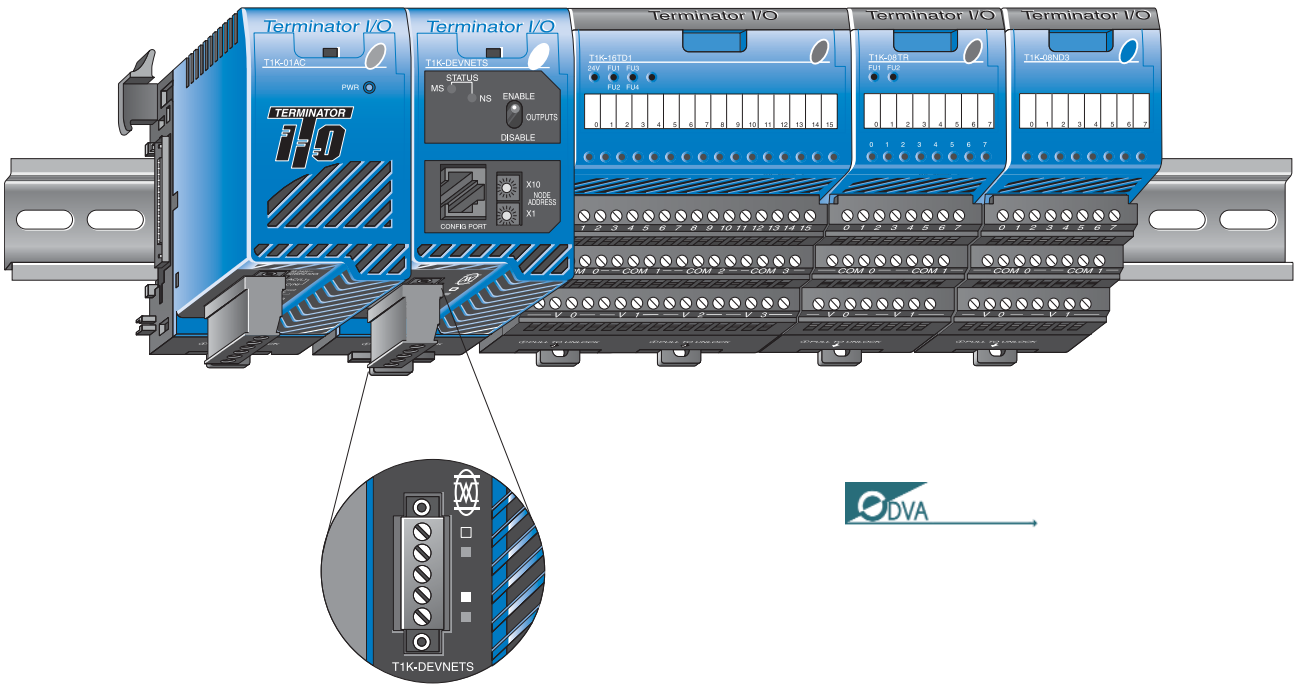
General Specifications	
DeviceNet Compatibility	Predefined Group 2 master/slave communications
Maximum Field Devices per Bus	64 (see table next page)
Maximum I/O Points per DEVNETS	1024 input bits (analog or discrete 1024 output bits (analog or discrete as specified by DeviceNet Slave Polling Specification
Communication to Field Devices	Standard 4-wire shielded cable to cabinet connector, molded 4-wire cable @ up to 500Kbps to field devices
Serial Port	RS232C, RJ12, Protocol support: K-sequence, ASCII
Module Connector	5-position removable terminal (European style)
Operating Temperature	0 to 55°C (32 to 131°F)
Storage Temperature	-20 to 70°C (-4 to 158°F)
Relative Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3-304,Impulse noise 1ms, 1000V FCC class A, RFI (144Mhz, 430Mhz 10W, 10cm)

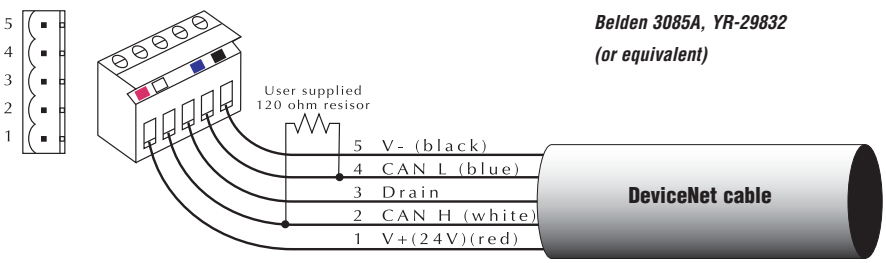


Connect our Terminator I/O

to your DeviceNet network.

DeviceNet Slave





Recommended cable:
Belden 3085A, YR-29832
(or equivalent)

Please Note:

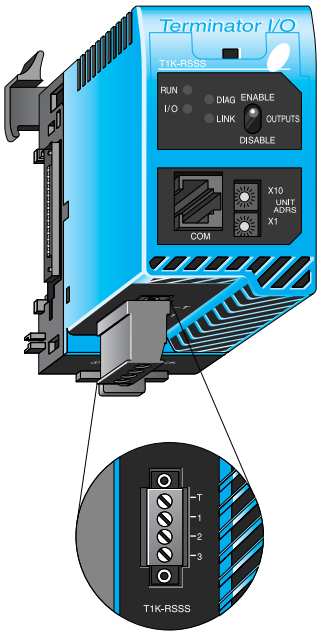
1. ***For use with Think & Do Software, we recommend the SST DeviceNet PCI Master Card, part number 5136-DNP-PCI. (AutomationDirect does not provide this interface). See www.mysst.com for more information.***
2. ***Terminator I/O DeviceNet slave network interface module T1K-DEVNETS is an ODVA certified DeviceNet-compliant slave I/O interface product. See www.odva.com for more information.***

Trunk Length		Comm Speed	Branch Length		Devices
Feet	***Meters***	***Baud***	***Feet***	***Meters***	***Maximum***
328	100	500 Kbps	20	6	64
820	250	250 Kbps	20	6	64
1,640	500	125 Kbps	20	6	64

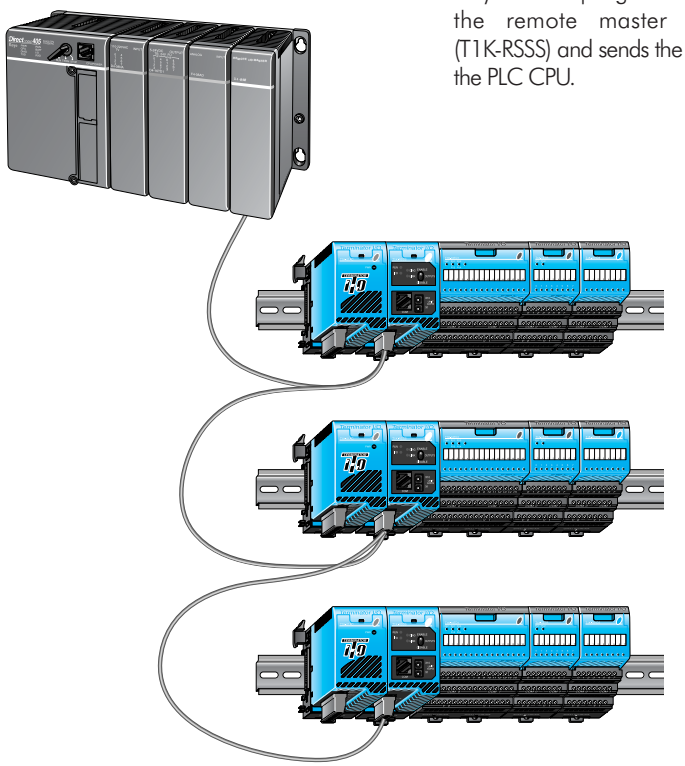
For other DeviceNet specifications, compatible products and latest DeviceNet information, contact:
Open DeviceNet Vendor Association
Contact: Executive Director Katherine Voss
Phone: 734/975-8840 • Fax: 734/922-0027
Internet address: http://www.odva.org
e-mail: odva@odva.org
ODVA, Inc. • 1099 Highland Drive, Suite A, Ann Arbor, MI. 48108

*Direct*LOGIC Remote I/O Slave

T1K-RSSS <--->



A Terminator I/O system can connect to *Direct*LOGIC PLCs using either of our proprietary networking protocols. Most of the DL205, DL305, and DL405 PLCs can serve as a Remote I/O Master[1] when a communication master module (for example, D2-RMSM) is added. The remote I/O protocols are also embedded in the D2-250-1,D2-260, D3-350, and D4-450 CPUs. On these CPUs, a networking connection is available via one of the built-in communication ports so you don't have to add a communication module.



Remote slave/Slice slave

The Terminator I/O T1K-RSSS network interface module serves as a slave to any of the *Direct*LOGIC PLCs that can act as a remote master (using the RM-NET protocol) or slice master (using the SM-NET protocol). The primary differences between the protocols are the maximum number of remote nodes that are supported and the communication baud rates. (*See Specifications table on this page.*)

Easy, low-cost networking

Terminator I/O systems can be daisy chained up to a distance of 3,900 feet from the local *Direct*LOGIC PLC using a recommended twisted pair communication cable. You can assign normal input and output addresses to the remote points by using a few simple lines of setup logic in your RLL program. During operation, the remote master polls the slaves (T1K-RSSS) and sends the remote I/O status to the PLC CPU.

Mixing systems

Terminator I/O (T1K-RSSS) remote I/O systems can be mixed with DL205 and DL405 remote I/O systems within the same channel as long as the same protocol (RM-NET or SM-NET) is being used.

Asynchronous communications

The communication between the remote master and CPU is asynchronous to the CPU scan. For this reason, remote I/O should be used in applications that do not require the remote I/O points to update during every CPU scan.

[1]Consult the PLC section of this catalog for more details.

Note: The T1K-RSSS does not support the T1H-CTRIO High-Speed Counter I/O module.

Specifications		
Cable Length: Baud Rate	***RM-NET***	1.2 km (3900 ft): 19.2 K or 38.4 Kbaud
	SM-NET	100 m (328 ft): 614.4 Kbaud 300 m (984 ft): 307.2 Kbaud 600 m (1968 ft): 153.6K baud 1,200 m (3900 ft): 19.2 K or 38.4 Kbaud
Recommended Cable		Belden 9841 or equivalent (120 Ohm impedance, 12pF/ft)
Terminal Type		Four-position removable terminal
Remote I/O Masters	***RM-NET***	D2-RMSM, D4-RM D2-260 15-pin port D2-250(-1) 15-pin port D3-350 25-pin port D4-450 25-pin port
	SM-NET	D2-RMSM
Number of Masters per PLC CPU		Check PLC CPU remote I/O specifications
Max. Slave I/O Points per PLC CPU		
Channel Capacity	***RM-NET***	7 slave stations
	SM-NET	31 slave stations
Serial Comm Port	***SM-NET only***	RJ12 9600 baud RS-232 K-sequence (for *Direct*SOFT programming or operator panel connection only)
Base Power Requirement		250 mA

High-Speed Counter I/O Module

HIgh-Speed Counter I/O Module

T1H-CTRIO <--->

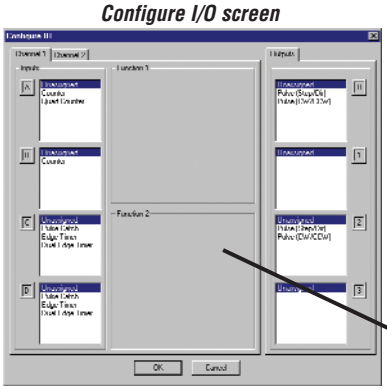
Overview

The High-Speed Counter I/O (CTRIO) module is designed to accept high-speed pulse-type input signals for counting or timing applications and to provide high-speed pulse-type output signals for stepper motor control, monitoring, alarm or other discrete control functions. The CTRIO module offers great flexibility for applications that call for precise counting or timing, based on an input event or for high-speed control output applications.

The CTRIO module has its own microprocessor and operates asynchronously with respect to the PLC/controller. This means that the on-board outputs respond in real time to incoming signals, so there is no delay waiting for the PLC/Controller to scan I/O.

The T1H-CTRIO module is designed to work with incremental encoders or other field devices that send pulse outputs.

Configure I/O screen



Use Configure I/O dialog to assign the CTRIO input and output functions

CTRIO features

The CTRIO modules offer the following I/O features:

- Eight DC sink/source inputs, 9-30 VDC
- Four isolated sink/source DC outputs, 5-30 VDC, 1A per point

Inputs supported:

- Two quadrature encoder counters up to 100 kHz, or four single-channel counters up to 100 kHz using module terminals Ch1A, Ch1B, Ch2A and Ch2B
- High-speed edge timers, dual edge timers, pulse catch, count reset, count inhibit , or count capture or home search limits using module terminals Ch1C, Ch1D, Ch2C or Ch2D

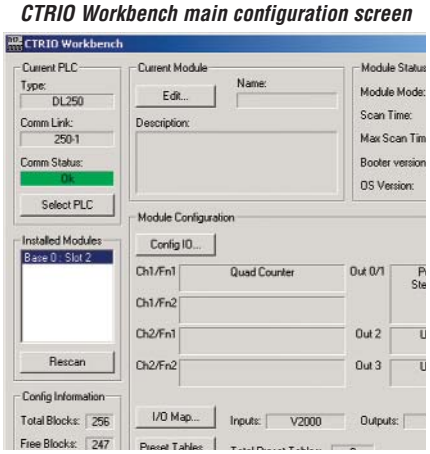
Outputs supported:

- Four independently configurable high-speed discrete outputs or two channels pulse output control (20 Hz-25 kHz per channel or 50 kHz if only using one channel)
- Pulse and direction or cw/ccw pulses supported for pulse output control
- Raw control of discrete output directly from user control program

Software configuration

All scaling and configuration is done via CTRIO Workbench, a Windows software utility program. This eliminates the need for PLC ladder programming or other interface device programming to set up the module. CTRIO Workbench runs under Windows 98/2000/XP and NT 4.0 SP5 or later.

CTRIO Workbench main configuration screen



Typical applications

- High-speed cut-to-length operations using encoder input
- Pick-and-place or indexing functions controlling a stepper drive
- Dynamic registration for web material control
- Accurate frequency counting for speed control with onboard scaling
- PLS (Programmable Limit Switch) functions for high-speed packaging, gluing, or labeling
- Sub 10 μsec pulse-catch capability for high-speed product detection
- Functions for level or flow

Supported systems

Multiple T1H-CTRIO modules can reside in the same I/O system provided that the base power budget is adequate.

PC-based Ethernet I/O control systems

The T1H-CTRIO module can be used in PC-based control systems using the T1H-EBC(100) interface module.

PROFIBUS systems

The T1H-CTRIO module can be used in Profibus systems using the T1H-PBC slave interface module.

ERM to EBC systems

The T1H-CTRIO module is supported in T1H-EBC(100) slaves in H*-ERM systems.

Notes:

1. ***The T1H-CTRIO module is not supported when using the T1K-RSSS, T1K-MODBUS, T1K-DEVNETS contoller modules.***
2. ***System functions are not available when CTRIO is used in ERM/EBC expansion I/O.***

High-Speed Counter

I/O Specifications

General	
Module Type	Intelligent
Modules Per Base	Limited only by power consumption
I/O Points Used	None, I/O map directly in PLC V-memory or PC control access
Field Wiring Connector	Standard removable terminal block
Internal Power Consumption	400 mA Max at +5V from Base Power Supply, Maximum of 6 Watts (All I/O in ON State at Max Voltage/Current)
Operating Environment	32°F to 140°F (0°C to 60°C), Humidity (non-condensing) 5% to 95%
Manufacturer	Host Automation Products, LLC
Isolation	2500 V I/O to Logic, 1000 V among Input Channels and All Outputs

T1H-CTRIO Input Specifications	
Inputs	8 pts sink/source
Minimum Pulse Width	5 µsec
Input Voltage Range	9-30 VDC
Maximum Voltage	30 VDC
Input Voltage Protection	Zener Clamped at 33 VDC
Rated Input Current	8 mA typical 12 mA maximum
Minimum ON Voltage	9.0 VDC
Maximum OFF Voltage	2.0 VDC
Minimum ON Current	5.0 mA (9 VDC required to guarantee ON state)
Maximum OFF Current	2.0 mA
OFF to ON Response	Less than 3 µsec
ON to OFF Response	Less than 3 µsec

T1H-CTRIO Output Specifications	
Outputs	4 pts, independently isolated, current sourcing or sinking FET Outputs: open drain and source with floating gate drive
Voltage Range	5 VDC - 36 VDC
Maximum Voltage	36 VDC
Output Clamp Voltage	60 VDC
Maximum Load Current	1.0 A
Maximum Load Voltage	36 VDC
Maximum Leakage Current	100 µA
Inrush Current	5 A for 20 ms
OFF to ON Response	Less than 3 µsec
ON to OFF Response	Less than 3 µsec
ON State V Drop	≤ 0.3 V
External Power Supply	For loop power only, not required for internal module function*
Overcurrent Protection	15 A max
Thermal Shutdown	Tjunction = 150°C
Overtemperature Reset	Tjunction = 130°C
Duty Cycle Range	1% to 99% in 1% increments (default = 50%)
Configurable Presets a) single b) multiple	a) Each output can be assigned one preset, or b) Each output can be assigned one table of presets, one table can contain max. 128 presets, max. predefined tables = 255

**** User supplied power source required for stepper drive configuration.***

T1H-CTRIO Input Resources	
Counter/Timer	4, (2 per 4 input channel group) up to 100 kHz
Resource Options	1X, 2X, or 4X Quadrature, Up or Down Counter, Edge Timer, Dual Edge Timer, Input Pulse Catch, Reset, Inhibit, Capture
Timer Range / Resolution	4.2 billion (32 bits); 1 µsec
Counter Range	± 2.1 billion (31 bits + sign bit)

T1H-CTRIO Output Resources	
Pulse output / Discrete outputs	Pulse outputs: 2 channels (2 outputs each channel) Discrete outputs: 4 pts.
Resource Options	Pulse outputs: pulse/direction or cw/ccw; Profiles:Trapezoid, S-Curve, Symmetrical S-Curve, Dynamic Position, Dynamic Velocity, Home Search, Velocity Mode, Run to Limit Mode and Run to Position Mode Discrete outputs: 4 configurable for set, reset, pulse on, pulse off, toggle, reset count functions (assigned to respond to Timer/Counter input functions). Raw mode: Direct access to discrete output from user application program
Target Position Range	± 2.1 billion (32 bits or 31 bits + sign bit)

High-Speed Counter

Status indicators

T1H-CTRIO LED Descriptions	
OK	Module OK
ER	User Program Error
1A - 1D	Ch1A - Ch1D Input Status
2A - 2D	Ch2A - Ch2D Input Status
CH1	Channel 1 Status
CH2	Channel 2 Status
Y0 - Y3	Output Status

T1H-CTRIO- LED Diagnostic Definitions		
LED OK	***LED ER***	***Description***
ON	OFF	All is well - RUN Mode
ON	ON	Hardware Failure
Blinking	Blinking	Boot Mode - Used for Field OS Upgrades
Blinking	OFF	Program Mode
OFF	Blinking	Module Self-diagnostic Failure
OFF	ON	Module Error Due to Watchdog Timeout
OFF	OFF	No Power to Module

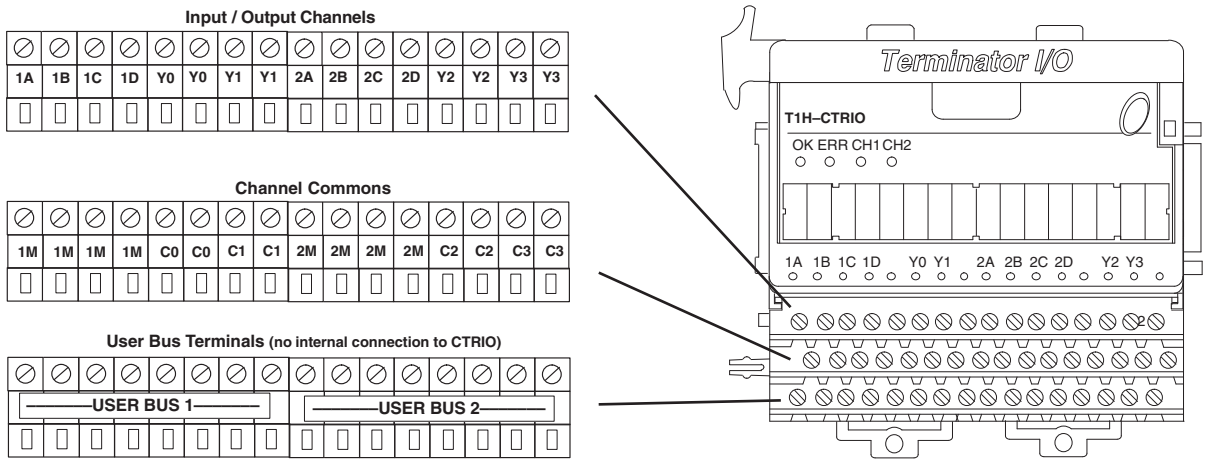
T1H-CTRIO LED Diagnostic Definition	
CH1	Blinks when Channel 1 Function 1 is counting or timing
CH2	Blinks when Channel 2 Function 1 is counting or timing
Y0 - Y3	Follow actual output state; ON = output is passing current

Installation and wiring

The T1H-CTRIO module has two independent input channels, each consisting of four optically isolated input points (points 1A-1D on common 1M and points 2A-2D on common 2M). The inputs can be wired to either sink or source current. The module has four optically isolated output points (points Y0-Y3 on isolated commons C0-C3, respectively). The outputs must be wired so that positive current flows into the Cn terminal and then out of the Yn terminal (see the diagram below and the schematic on the following page).

The module is configured, using CTRIO Workbench, to accommodate the user's application. The function of each input (counting, timing, reset, etc.) and output (pulse output, discrete output, etc.) is defined in the configuration of the module.

See the notes below for further details about power source considerations, circuit polarities, and field devices.



Notes:

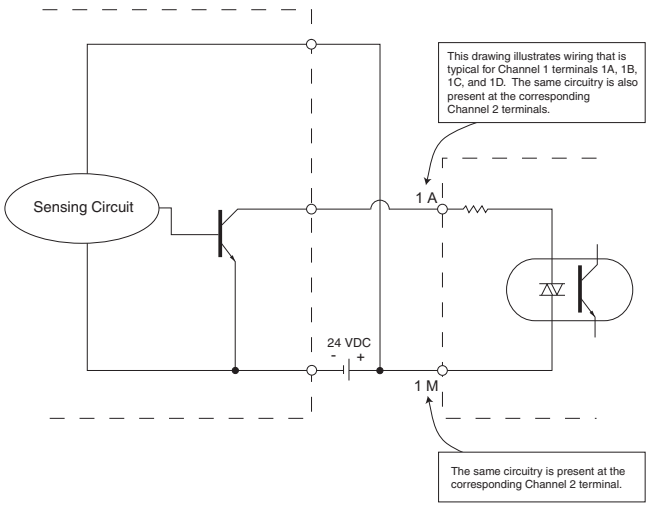
1. ***Inputs (1A, 1B, 1C, 1D and 2A, 2B, 2C, 2D) require user-provided 9-30 VDC power sources. Terminals 1M and 2M are the commons for Channel 1 and Channel 2 inputs. Maximum current consumption is 12 mA per input point.***
2. ***Polarity of the input power sources can be reversed. Consideration must be given, however, to the polarity of the field device. Many field devices are designed for only one polarity and can be damaged if power wiring is reversed.***
3. ***Outputs have one polarity only and are powered by user-provided 5-36 VDC power sources. The maximum allowable current per output circuit is 1A.***
4. ***User Bus 1 and User Bus 2 are independent 8-wire terminal buses. They can be used for additional power rail connections.***

High-Speed Counter

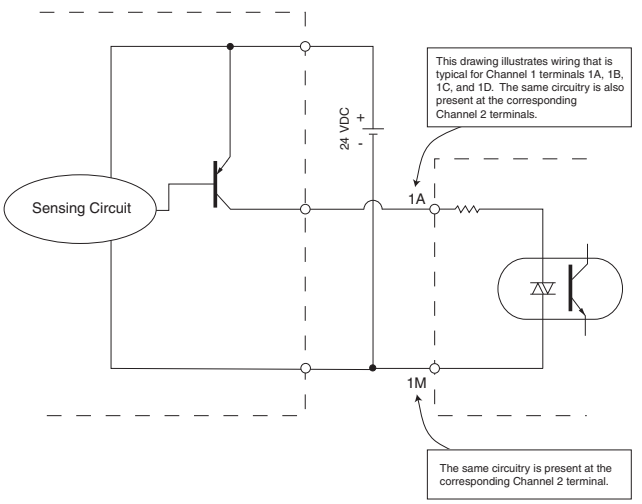
Solid state input wiring device

DC types of field devices are configured to either sink or source current. This affects the wiring of the device to the CTRIO module. Refer to the sinking/sourcing section of the appendix in this catalog for a complete explanation of sinking and sourcing concepts.

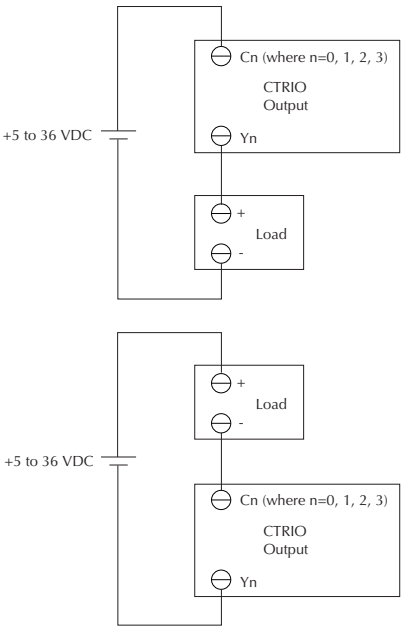
NPN Field Device (sink)



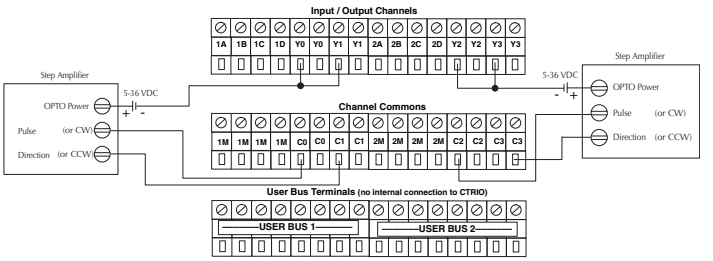
PNP Field Device (source)



Pulse output schematic



Stepper/servo drive wiring example

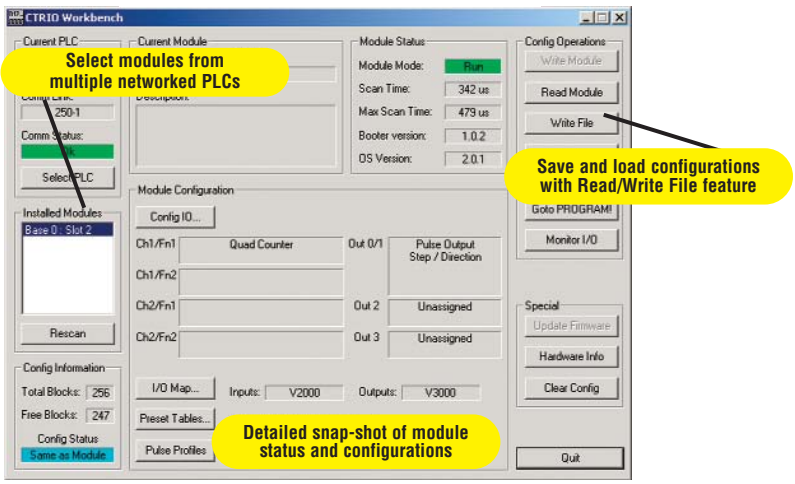


High-Speed Counter

Fill-in-the-blank configuration software

The CTRIO Workbench is the software utility used to configure the CTRIO module and to scale signals to desired engineering units. Workbench also allows you to perform various other functions, such as switching between the CTRIO's Program mode and Run mode, monitoring I/O status and functions, and diagnostic control of module functions. The CTRIO Workbench utility ships with the CTRIO User Manual. You can also download the latest version free at the Host Automation Products, L.L.C. Web site: www.hosteng.com.

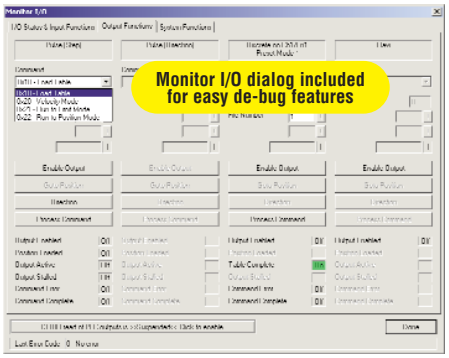
CTRIO Workbench main configuration screen



CTRIO Workbench diagnostics and monitoring

The Monitor I/O dialog is accessible from the main Workbench dialog when the module is in Run Mode. This allows for a convenient way to test and debug your configuration prior to installation. The Monitor I/O dialog is divided into three functional areas: Input Functions, Output Functions and System Functions. The data displayed under the Input Functions tab includes all input Dword parameters, status bits and the current status of each configured input and output function. The fields displayed under the Output Functions tab includes all output Dword parameters and configuration information that can be altered during runtime and the bits that indicate successful transfers or errors. The System Functions can be used to read from or write to the CTRIO's internal registers.

Monitor I/O screen

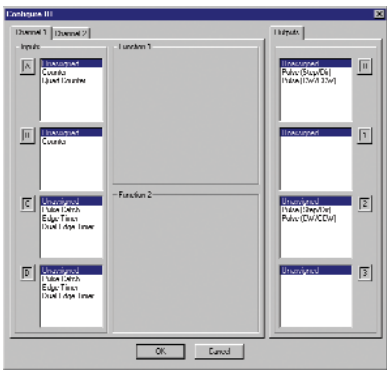


CTRIO Workbench configure I/O setup

The Configure I/O dialog is the location where input and output functions are assigned to the module. The choice of input and output functions determines which options are available. The input function boxes prompt you with selections for supported functions. The Workbench software automatically disallows any unsupported configurations.

T1H-CTRIO

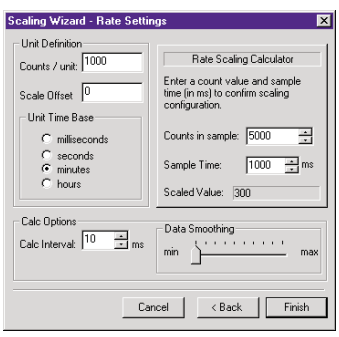
Configure I/O screen



CTRIO Workbench on-board scaling

Scaling raw signals to engineering units is accomplished using the Scaling Wizard. The Scaling Wizard options are different for the Counter functions as compared with the Timer functions. "Position" and "Rate" scaling are available when you select a Counter function. "Interval" scaling is available when you select a Timing function.

Scaling Wizard screen



High-Speed Counter

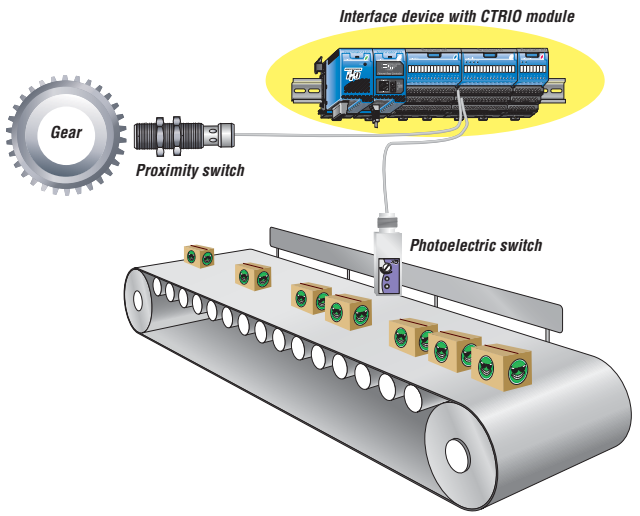
High-speed input operations

The CTRIO module is capable of a wide variety of high speed input and output operations all within one module. With its flexible 2-channel input and separate 2-channel output design, the CTRIO can satisfy both high-speed counting, timing, pulse catch operations, along with high speed discrete output or several profile choices of pulse output operations. Not all combinations of input functions and output functions are possible within the resources of the module, but the following examples are some of the most common applications for the CTRIO. Check out these examples and see how they relate to your high speed application needs.

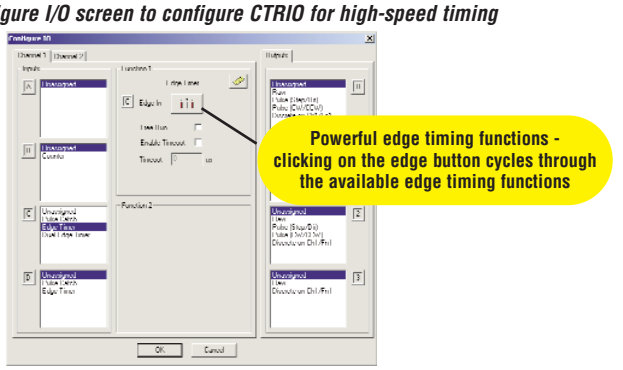
High-speed timing

The CTRIO can be configured for timing functions based on both count or rate. Using a common configuration of a proximity switch sensing the teeth on a gear, the module is able to calculate the velocity of the gear based on the rate it receives its counts. This value can be scaled within the module to the engineering units required for the application.

High-speed timing application



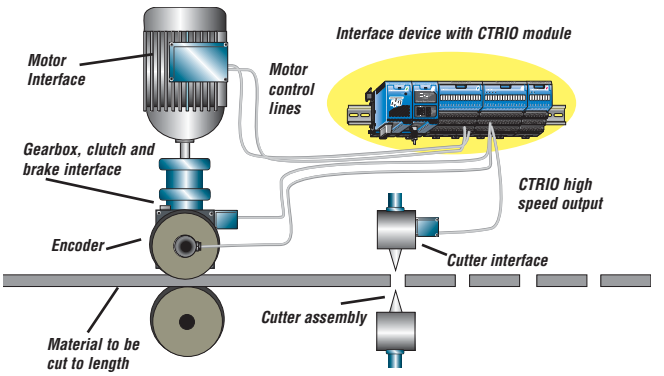
Using Configure I/O screen to configure CTRIO for high-speed timing



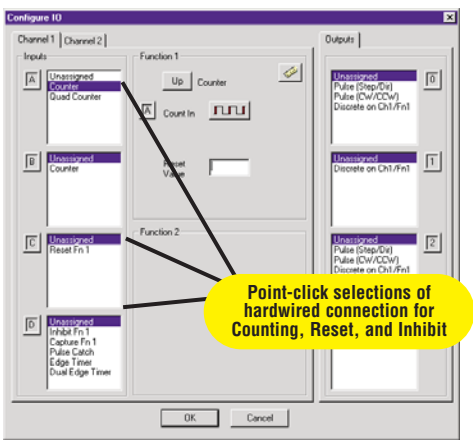
High-speed counting

The CTRIO can be configured for counting functions for the use of an encoder input, (up to two quadrature encoders per module) with available connections for external reset and inhibit signals. In a simple cut to length application as shown, the encoder provides an input position reference for the material to the module. The module's high speed outputs are wired to the cutting device and to the clutch and/or braking device. When the count from the encoder is equal to a pre-programmed setpoint within the module, the high speed outputs are activated to stop and cut the material to a repeatable fixed length. Additionally, the clutch/brake signal can be used for an inhibit signal to not accumulate counts while the material is being cut.

High-speed cut-to-length application



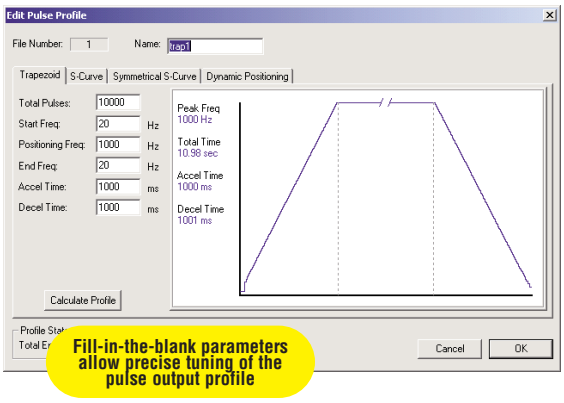
Using Configure I/O screen to configure CTRIO for high-speed counting

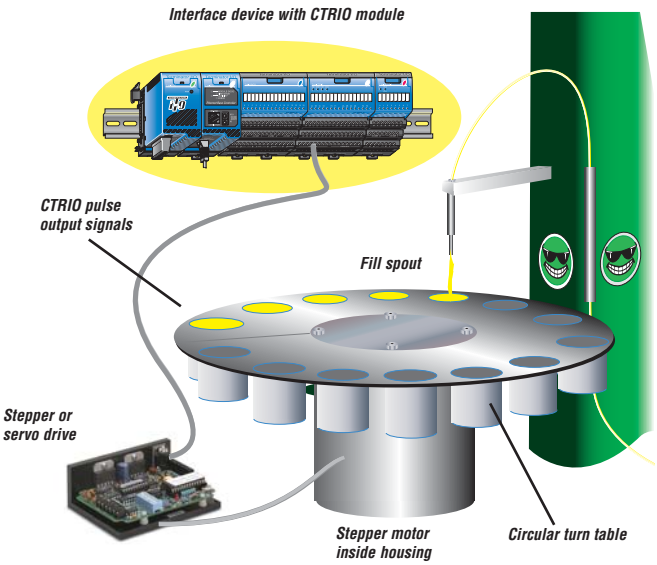


High-Speed Counter

Pulse output operations

Using Edit Pulse Profile screen to select Trapezoid pulse output profile





Rotary indexing liquid fill application

Pulse output for stepper/servo control

The CTRIO module is capable of multiple configurations for pulse output control, most often when connected to a stepper or servo drive system. The module can deliver a pulse output signal up to a maximum of 25 kHz on two channels with support for pulse-and-direction or CW/CCW pulses. The available profile choices include Trapezoid, S-Curve, Symmetrical S-Curve, Dynamic Positioning, and Pulse to Limit. All profiles can be easily configured using the CTRIO Workbench software with fill-in-the-blank parameter fields and a graphic representation of the selected profile. Three additional profiles are available that are completely controlled by the user program (no CTRIO profile is configured). They are Velocity Mode, Run to Limit Mode and Run to Position Mode.

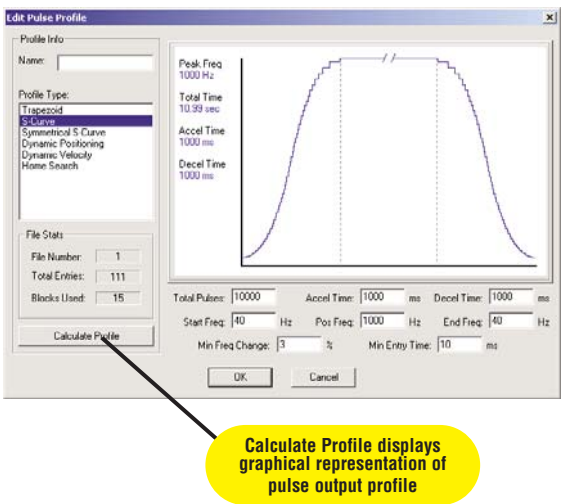
Example application

In a simple rotary indexing application, as shown above, a fixed Trapezoid profile is chosen. The CTRIO for this application is wired to a stepper drive for pulse-and-direction. The requirement for this application is to provide a smooth movement of the rotary table to allow product to be filled into individual containers equal distance apart. The predetermined number of pulses required for each movement is entered into the CTRIO Workbench as "Total Pulses" along with the Starting Frequency, Ending Frequency, and Positioning Frequency (speed after acceleration). The Acceleration and Deceleration parameters are entered in units of time, so no ramp-distance calculations are required. After all parameters are entered, a graphical representation of the configured profile is shown automatically. Once the configuration has been downloaded to the module, all that is needed from the PLC CPU is the Enable Output signal to begin a movement.

Other common pulse output applications:

- S-Curve accel/decel profile for signaling a stepper or servo drive that needs a curved acceleration and deceleration pro file, i.e. for diminishing any initial "jerk" upon movement of static products, boxes on conveyors, liquids in containers on an indexer, printing registrations, etc.
- Dynamic Positioning for any run-to-a-specific-position requirement, either by a pre-programmed count of an external high speed discrete input wired to the module. This is popular in winding or webcontrol with any dynamic registration mark or variable speed requirement.
- Home Search routines to seek a home position based on CTRIO discrete input limit(s).

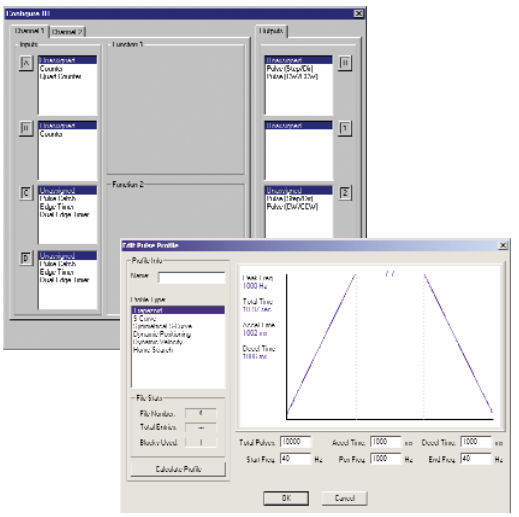
Example of S-Curve acceleration and deceleration pulse output profile



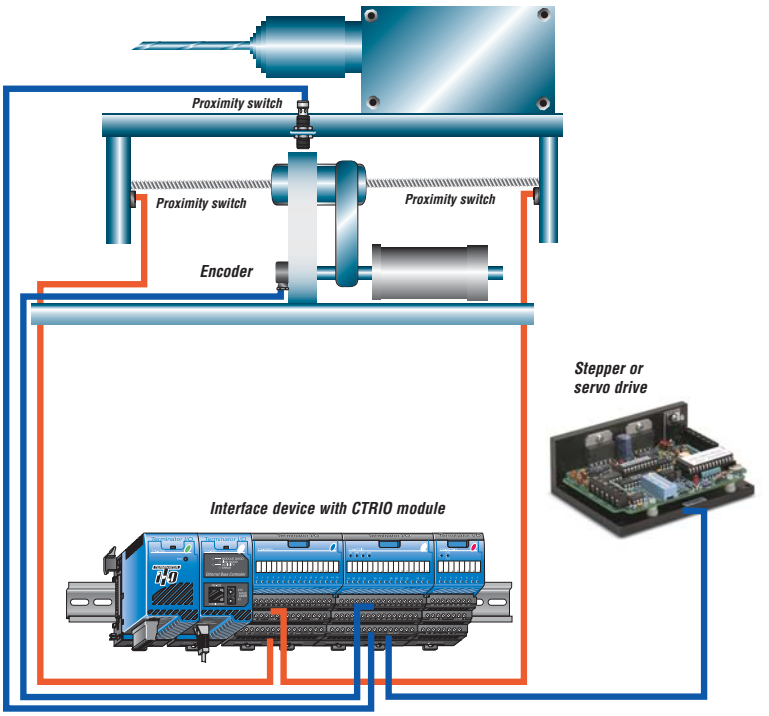
High-Speed Counter

Combining high-speed input and pulse output operations

Using CTRIO Workbench to configure the module for simultaneous high-speed input and high-speed pulse output operation



Multihead drill machine application

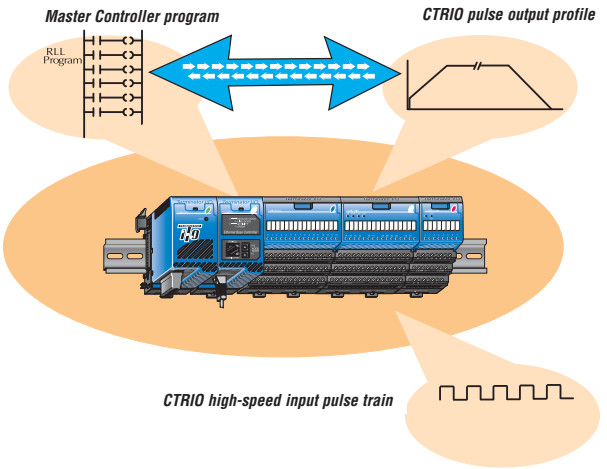


High-Speed inputs and pulse output combinations

The flexible design of the CTRIO module allows for combining high speed inputs and delivering high speed pulse outputs signals simultaneously. There are limitations to this type of configuration in that the module does not internally support closed loop control. Providing closed loop control with the CTRIO involves additional PLC code to coordinate this control, making the application subject to the PLC CPU program scan. Simple position/speed monitoring, via a high speed counting input for non-critical response while providing pulse outputs to a drive, is easily achievable for the CTRIO.

Example application

In the simple drill-head application shown above, the CTRIO pulse outputs are wired to a stepper and/or servo drive. The inputs are wired to an encoder attached to the lead screw on the movable portion of the drill-head assembly. The CTRIO module output pulse train to the drive allows the motor to spin the lead screw making the drill move forward into the passing material. The encoder monitors the speed and position of the drill-head. Prox switches at each end act as limit switches ensuring the drill-head will not over-travel. A home sensor is positioned in the middle of the assembly, allowing the PLC to reset the count.



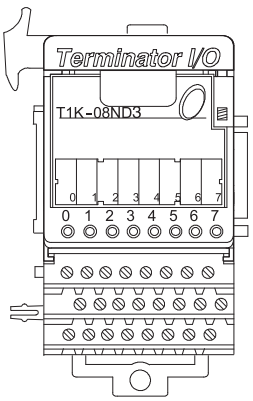
Note: Closed loop control for the CTRIO module requires control program interaction to close the loop. This makes the application subject to the master controller scan.

DC Input Modules

T1K-08ND3 <--->

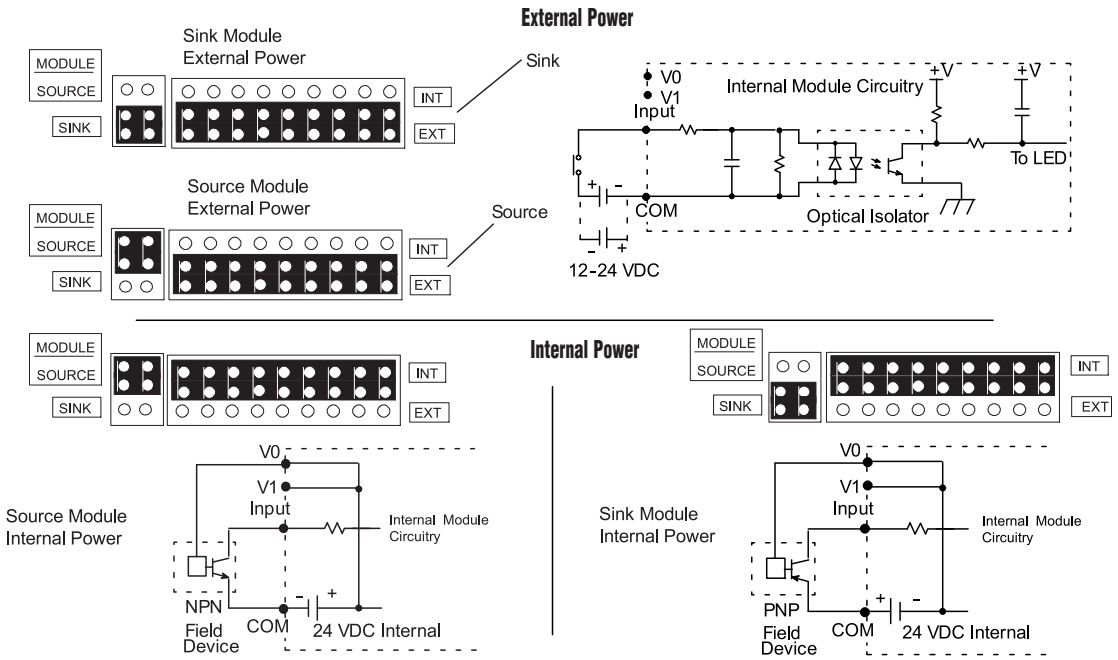
8-point 12/24VDC input module

The 8-point DC module uses a T1K-08B or T1K-08B-1 base, which is purchased separately.



Module Specifications	T1K-08ND3
Inputs Per Module	8 (sink/source)
Commons, Non-isolated	Ext. power: 2, isolated (4 pts. /com) Int. power: 2, all 8 pts. internally connected
Operating Voltage Range	12-24VDC
Input Voltage Range	10.8-26.4 VDC min./max.
Peak Range	30 VDC
Input Current (Typical)	4mA @ 12 VDC, 8.5mA @ 24 VDC
Input Impedance	2.8 KΩ
ON Voltage Level	> 10.0 VDC
OFF Voltage Level	< 2.0 VDC
Min. ON Current	4mA
Max. OFF Current	0.5mA
OFF to ON Response	2-8ms, Typ: 4ms
ON to OFF Response	2-8ms, Typ: 4ms
Base Power Required	35mA @ 5VDC
Status Indicators	Logic side
Weight	70g

Note: When using external power, the module can be wired to either sink current or source current regardless of the module's sink/source jumper position. When using internal power, the sink/source jumpers determine the module's configuration.

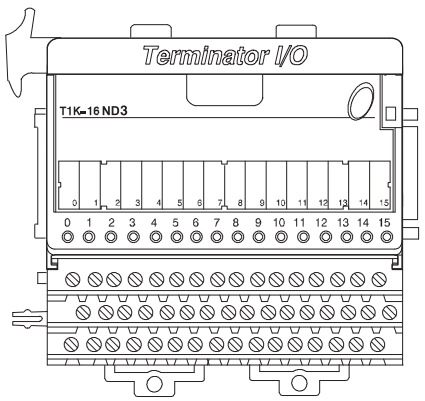


DC Input Modules

T1K-16ND3 <--->

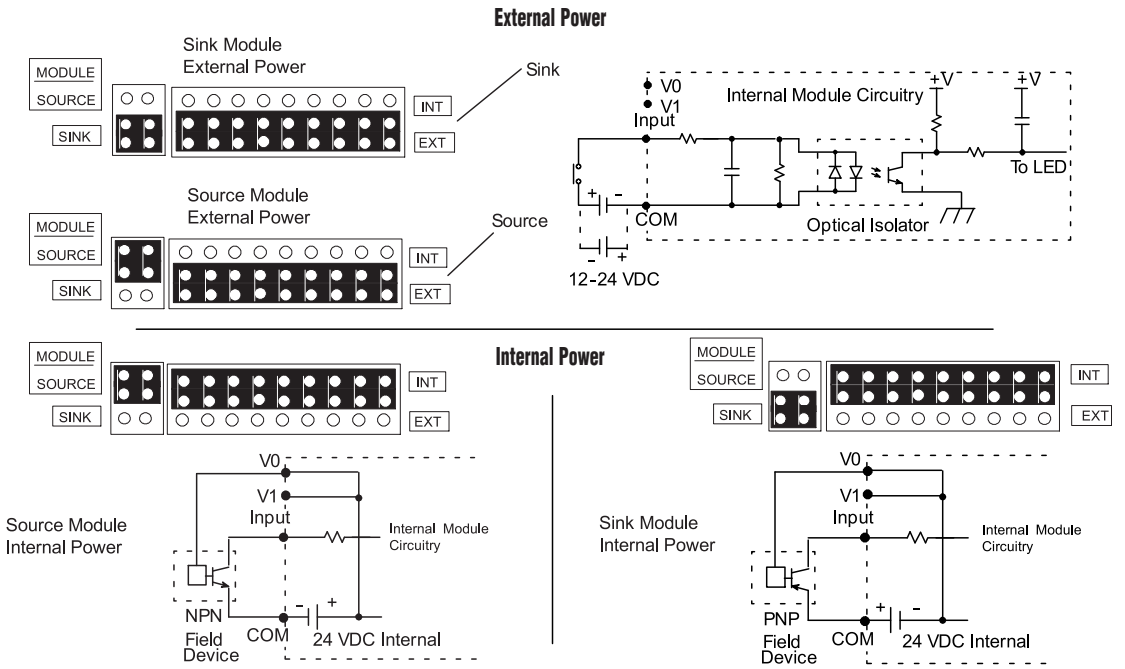
16-point, 12/24 VDC input module

The 16-point DC module uses a T1K-16B or T1K-16B-1 base, which is purchased separately.



Module Specifications	T1K-16ND3
Inputs Per Module	16 (sink/source)
Commons, Non-isolated	Ext. power: 4, isolated (4 pts. /com) Int. power: 4, all 16 pts. internally connected
Operating Voltage Range	12-24 VDC
Input Voltage Range	10.8-26.4 VDC
Peak Range	30 VDC
Input Current (Typical)	4 mA @ 12 VDC, 8.5 mA @ 24 VDC
Input Impedance	2.8 KΩ
ON Voltage Level	> 10.0 VDC
OFF Voltage Level	< 2.0 VDC
Min. ON Current	4 mA
Max. OFF Current	0.5 mA
OFF to ON Response	2-8 ms, Typ: 4 ms
ON to OFF Response	2-8 ms, Typ: 4 ms
Base Power Required	70 mA @ 5 VDC
Status Indicators	Logic side
Weight	160 g

Note: When using external power, the module can be wired to either sink current or source current regardless of the module's sink/source jumper position. When using internal power, the sink/source jumpers determine the module's configuration.



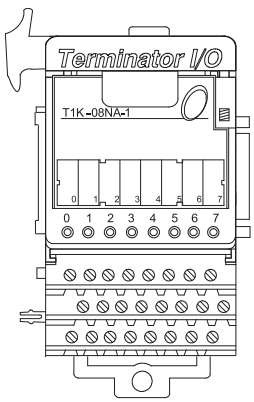
AC Input Modules

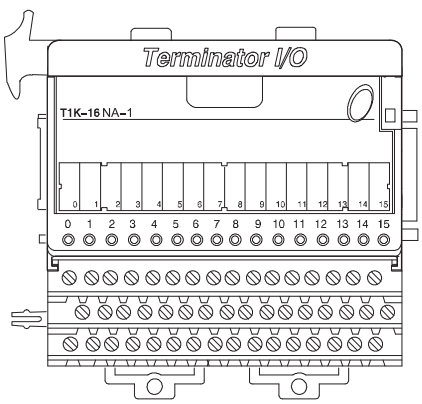
T1K-08NA-1 <---> T1K-16NA-1 <--->

8-point and 16-point, 90-120 VAC input modules

The 8-point AC input module uses a T1K-08B or T1K-08B-1 base, which is purchased separately.

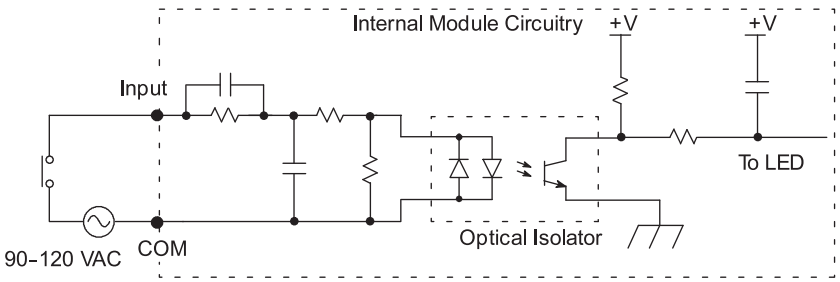
The 16-point AC input module uses a T1K-16B or T1K-16B-1 base, which is purchased separately.





Specifications	T1K-08NA-1	T1K-16NA-1
Inputs Per Module	8	16
Commons per Module	2, 4 pts. /com (isolated)	4, 4 pts. /com (isolated)
Input Voltage Range	80-132 VAC, 47-63 Hz	
Operating Voltage Range	90-120 VAC, 47-63 Hz	
Input Current	8 mA @ 100 VAC (50 Hz) 10 mA @ 100 VAC (60 Hz) 12 mA @ 132 VAC (50 Hz) 15 mA @ 132 VAC (60 Hz)	8 mA @ 100 VAC (50 Hz) 10 mA @ 100 VAC (60 Hz) 12 mA @ 132 VAC (50 Hz) 15 mA @ 132 VAC (60 Hz)
Input Impedance	14 KΩ @ 50 Hz, 12 KΩ @ 60 Hz	
ON Current/Voltage	> 6 mA @ 75 VAC	
OFF Current/Voltage	< 2 mA @ 20 VAC	
OFF to ON Response	< 40 ms	
ON to OFF Response	< 40 ms	
Base Power Required	35 mA @ 5 VDC	70 mA @ 5 VDC
Status Indicators	Logic side	
Weight	70 g	120 g

Equivalent Input Circuit



DC Output Modules

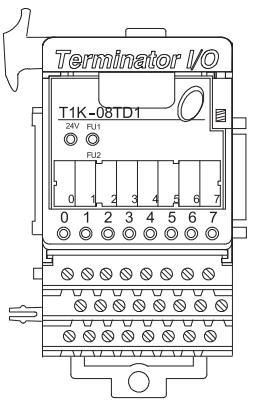
T1K-08TD1 <---->
T1K-16TD1 <---->

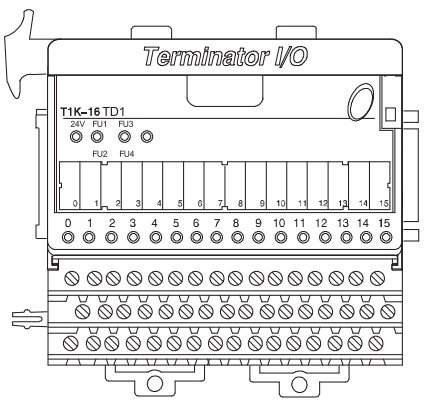
8-point and 16-point, current sinking DC output modules

The 8-point DC module uses a T1K-08B or T1K-08B-1 base, which is purchased separately.

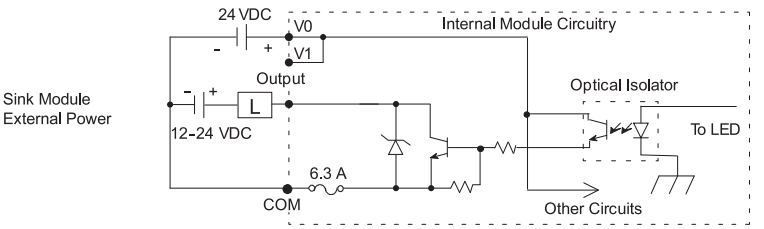
The 16-point DC module uses a T1K-16B or T1K-16B-1 base, which is purchased separately.

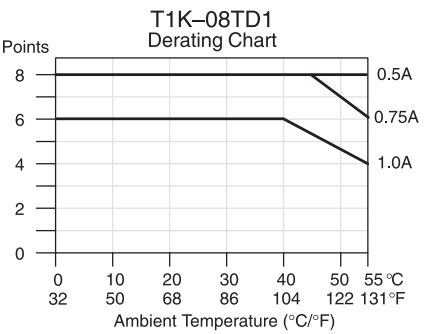
Specifications	T1K-08TD1	T1K-16TD1
Outputs per Module	8 (sink)	16 (sink)
Commons per Module	2 internally connected	4 internally connected
Operating Voltage Range	6-27 VDC min./max.	
Output Voltage Range	5-30 VDC min. / max.	
Peak Voltage	50 VDC	
Max. Output Current	1A / pt., 4A / common	
Max. Leakage Current	15 µA @ 30 VDC	
ON Voltage Drop	0.3 VDC @ 1.0A	
Max. Inrush Current	2A for 100 ms	
OFF to ON Response	< 10 µs	
ON to OFF Response	< 60 µs	
Base Power Required	100 mA @ 5 VDC	200 mA @ 5 VDC
External Power Required	200 mA max. @ 20-28 VDC	400 mA max. @ 20-28 VDC
Status Indicators	Logic side	
Error Status Indicators	24 V ON = low external power	
	FU1/FU2 ON = blown fuse	FU1/FU2 ON = fuse 1 or 2 blown FU3/FU4 ON = fuse 3 or 4 blown
Fuses (User Replaceable) T1K-FUSE-1	2	4
	(6.3 A, 250 V / common) NQ3-6.3 SOC Corp.	
Weight	85 g	140 g

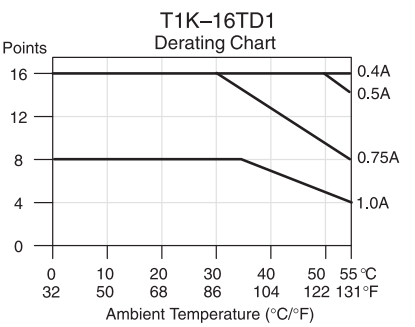




Equivalent Output Circuit







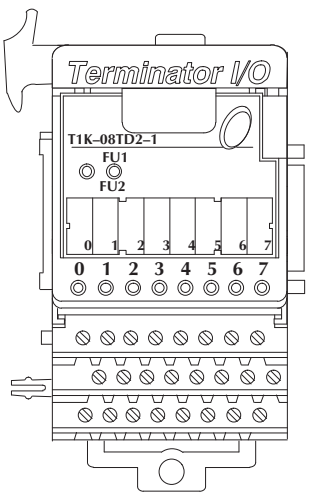
DC Output Modules

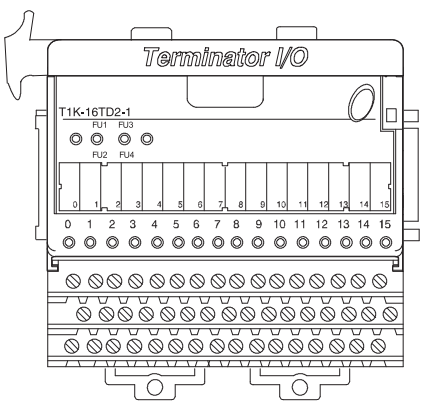
T1K-08TD2-1 <---> T1K-16TD2-1 <--->

8-point and 16-point, 12/24 VDC current sourcing DC output module

The 8-point DC module uses a T1K-08B or T1K-08B-1 base, which is purchased separately.

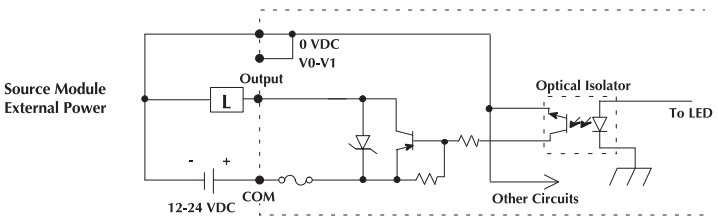
The 16-point DC module uses a T1K-16B or T1K-16B-1 base, which is purchased separately.

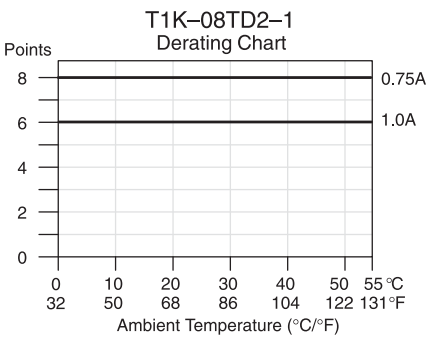


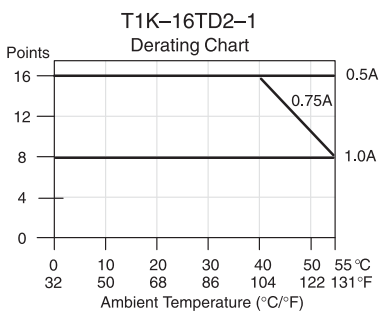


Specifications	T1K-08TD2-1	T1K-16TD2-1
Outputs per Module	8 (source)	16 (source)
Commons per Module	2 internally connected	4 internally connected
Output Voltage Range	10.8-26.4 VDC	
Operating Voltage Range	12-24 VDC	
Peak Voltage	50 VDC	
Max. Output Current	1A / pt., 4A / common	1A / pt., 4A / common (subject to derating)
Max. Leakage Current	15 µA @ 26.4 VDC	
ON Voltage Drop	1.2 VDC @ 1.0 A	
Max. Inrush Current	2A for 100 ms	
OFF to ON Response	< 10 µs	
ON to OFF Response	< 0.5 ms	
Base Power Required	100 mA @ 5 VDC	200 mA @ 5 VDC
Status Indicators	Logic side	
Error Status Indications(LEDs)	FU1/FU2 ON = fuse 1 or 2 blown	FU1/FU2 ON = fuse 1 or 2 blown FU3/FU4 ON = fuse 3 or 4 blown
Fuses (User Replaceable) T1K-FUSE-1	2 qty., (6.3 A, 250 V / common) NQ3-6.3 SOC Corp.	4 qty., (6.3 A, 250 V / common) NQ3-6.3 SOC Corp.
Weight	100 g	140 g

Equivalent Output Circuit





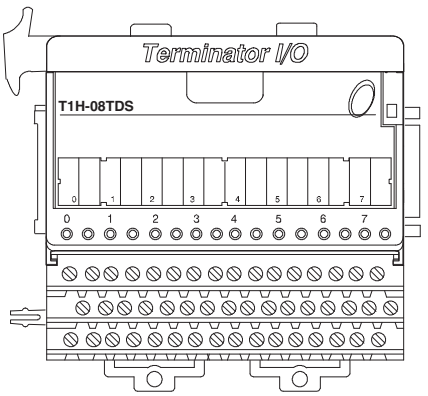


DC Output Modules

T1H-08TDS <--->

8-point isolated DC output module with electronic over current protection

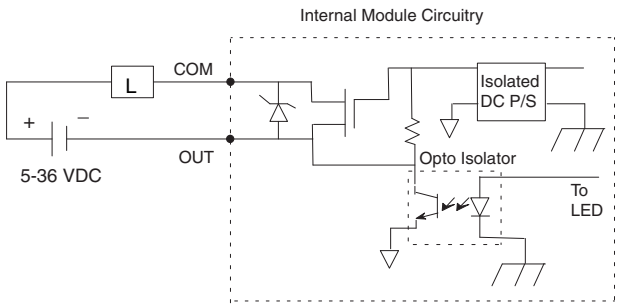
The 8-point DC module uses a T1K-16B or T1K-16B-1 base, which is purchased separately.



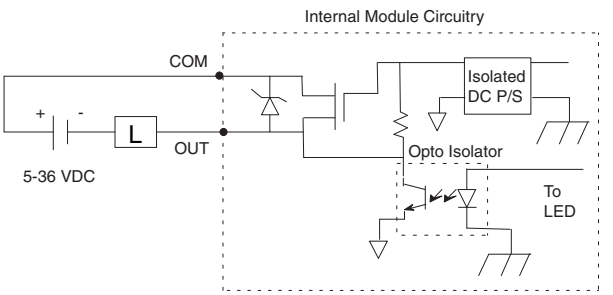
Module Specifications	T1H-08TDS
Outputs Per Module	8 (isolated, sink/source)
Commons	8 (isolated)
Operating Voltage Range	5-36 VDC
Max. Voltage	36 VDC
Output Clamp Voltage	40 VDC
Max. Load Current	2A per point, 16 A per module
Electronic Over Current Protection	Output trips at 6A min., 12 A max.
Max. Load Voltage	36 VDC
Max. Leakage Current	75 µA
Max. ON State Voltage Drop	0.3 V at 2A, 0.15 V at 1A
Inrush Current	5A for 20 ms
OFF to ON Response	<3 µsec
ON TO OFF Response	<100 µsec
Base Power Required	200 mA
External Power Required	None (Output FET gates driven internally)
Thermal Shutdown	Between Tjunction = 302-374ºF (150-190ºC)
Overtemperature Reset	Thermal shutdown temp. minus 5ºF (15ºC)
Status Indicators	Logic side
Weight	93.6 g

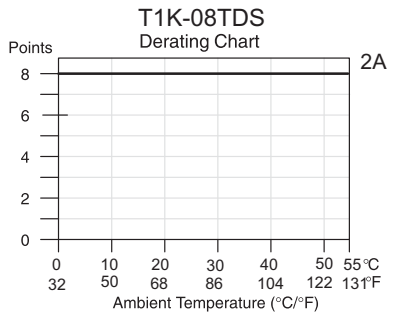
Equivalent Output Circuit

Sinking (Low Side Switching)



Sourcing (High Side Switching)





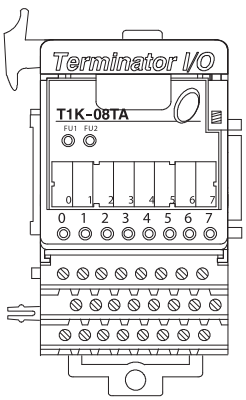
AC Output Modules

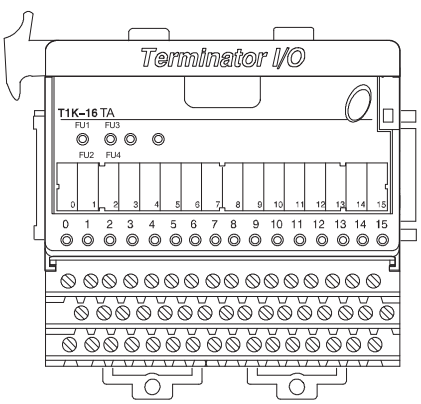
T1K-08TA <---->
T1K-16TA <---->

8-point and 16-point, AC output modules

The 8-point AC module uses a T1K-08B or T1K-08B-1 base, which is purchased separately.

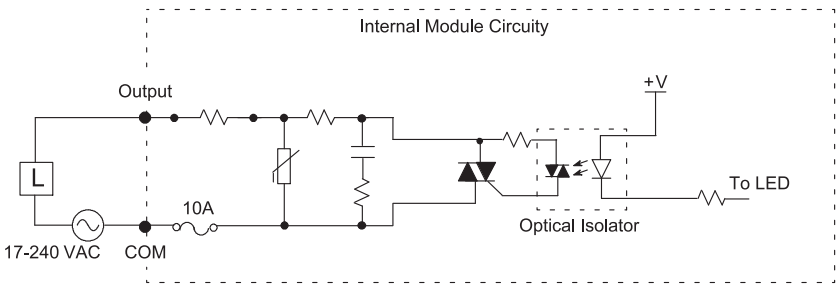
The 16-point AC module uses a T1K-16B or T1K-16B-1 base, which is purchased separately.

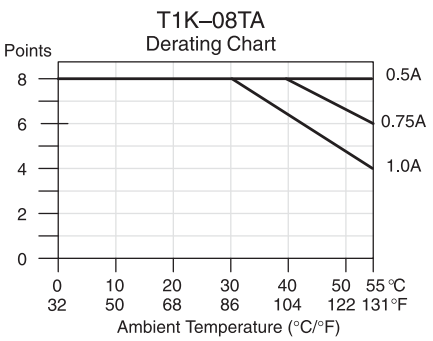


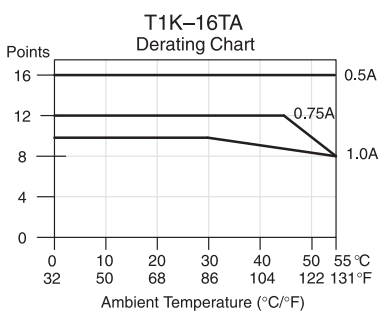


Specifications	T1K-08TA	T1K-16TA
Outputs per Module	8	16
Commons per Module	2 (4 pts. / common) isolated	4 (4 pts. / common) isolated
Operating Voltage Range	17-240 VAC (47-63Hz) min./max.	
Output Voltage Range	15-264 VAC (47-63Hz) min./max.	
Max. Load Current	1A / pt., 4A / common (subject to derating)	
ON Voltage Drop	1.5 VAC @ > 50 mA, 4.0 VAC @ < 50 mA	
Max. Leakage Current	4 mA @ 264 VAC	
Max. Inrush Current	10 A for 10 ms	
Min. Load	10 mA	
OFF to ON Response	< 1 ms	
ON to OFF Response	< 1 ms + 1/2 cycle	
Base Power Required	250 mA @ 5 VDC	450 mA @ 5 VDC
Status Indicators	Logic side	
Error Status Indications(LEDs)	FU1 ON = fuse 1 blown FU2 ON = fuse 2 blown	FU1/FU2 ON = fuse 1 or 2 blown FU3/FU4 ON = fuse 3 or 4 blown
Fuses (User Replaceable) T1K-FUSE-1	2, (10 A, 250 V / common) 5 x 20 mm type	4, (10 A, 250 V / common) 5 x 20 mm type
Weight	140 g	190 g

Equivalent Output Circuit





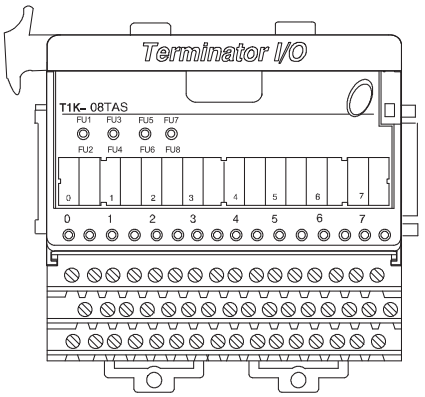


AC Output Modules

T1K-08TAS <--->

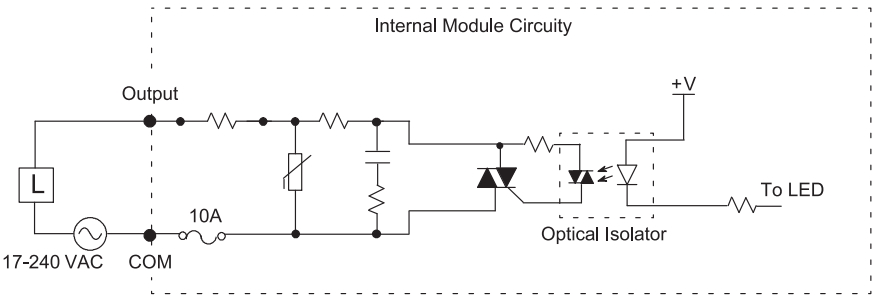
8-point, 17/240 VAC isolated output module

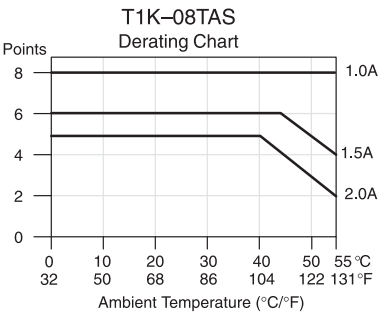
The 8-point AC module uses a T1K-16B or T1K-16B-1 base, which is purchased separately.



T1K-08TAS Output Specification	
Outputs per Module	8
Commons per Module	8, (1 pt /common) isolated
Operating Voltage Range	17-240 VAC (47-63Hz)
Output Voltage Range	15-264 VAC (47-63Hz)
Max. Load Current	2A / pt. 6A/common (subject to derating)
ON Voltage Drop	1.5 VAC @ > 50 mA, 4.0 VAC @ < 50 mA
Max. Leakage Current	4 mA @ 264 VAC
Max. Inrush Current	10 A for 10 ms
Min. Load	10 mA
OFF to ON Response	< 1 ms
ON to OFF Response	< 1 ms + 1/2 cycle
Base Power Required	300 mA @ 5 VDC
Status Indicators	Logic Side
Error Status Indications(LEDS)	FU1/FU2 ON = fuse 1 or 2 blown FU3/FU4 ON = fuse 3 or 4 blown FU5/FU6 ON = fuse 5 or 6 blown FU7/FU8 ON = fuse 7 or 8 blown
Fuses (User Replaceable) ***T1K-FUSE-3***	8, (10 A, 250 V / common), 1 pt. / fuse NQ3-10 SOC Corp.
Weight	190 g

Equivalent Output Circuit





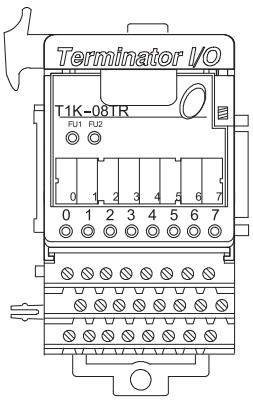
Relay Output Modules

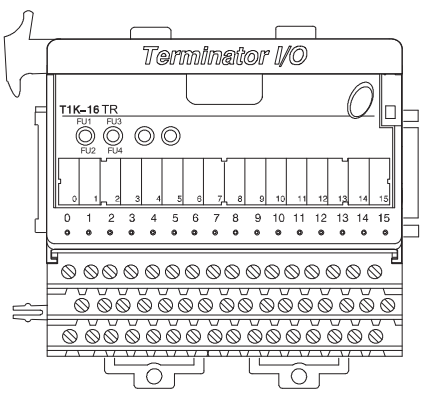
T1K-08TR <---->
T1K-16TR <---->

8-point and 16-point, relay output modules

The 8-point relay output module uses a T1K-08B or T1K-08B-1 base, which is purchased separately.

The 16-point Relay output module uses a T1K-16B or T1K-16B-1 base, which is purchased separately.

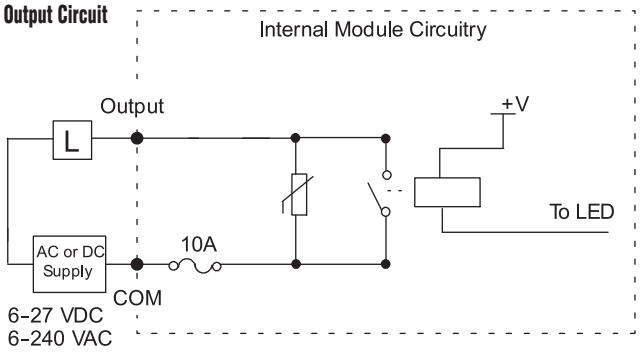


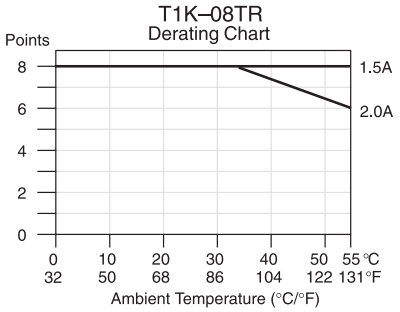


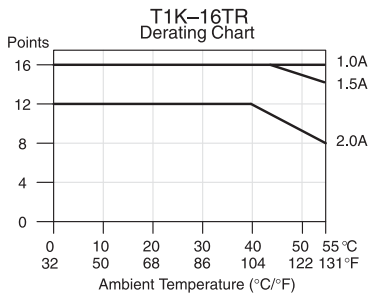
Specifications	T1K-08TR	T1K-16TR
Outputs per Module	8 normally open	16 normally open
Isolated Commons	2 (4 pts. / common) isolated	4 (4 pts. / common) isolated
Operating Voltage Range	6-240 VAC (47-63)Hz, 6-27 VDC	
Output Voltage Range	5-264 VAC (47-63Hz), 5-30 VDC min./max.	
Max. Load Current	2A / pt., 8A / common	2A / pt., 6A / common (subject to derating)
Max. Leakage Current	0.1 mA @ 264 VAC	
Max. Inrush Current	6A for 10 mS / pt.; 20 A for 10 mS / com.	
Min. Load	5 mA @ 5 VDC	
OFF to ON Response	< 15 ms	
ON to OFF Response	< 10 ms	
Base Power Required	350 mA @ 5 VDC	700 mA @ 5 VDC
Status Indicators	Logic side	
Error Status Indications(LEDs)	FU1 ON = fuse 1 blown FU2 ON = fuse 2 blown	FU1/FU2 ON = fuse 1 or 2 blown FU3/FU4 ON = fuse 3 or 4 blown
Fuses (User Replaceable) T1K-FUSE-1	2, (10 A, 250 V / common) 5 x 20 mm type	4, (10 A, 250 V / common) 5 x 20 mm type
Weight	110 g	200 g

Typical Relay Life (Operations)		
Voltage and Load Type	Load Current	
	1A	2A
24 VDC Resistive	500 K	250 K
24 VDC Solenoid	100 K	50 K
110 VAC Resistive	500 K	250 K
110 VAC Solenoid	200 K	100 K
220 VAC Resistive	350 K	200 K
220 VAC Solenoid	100 K	50 K

Equivalent Output Circuit





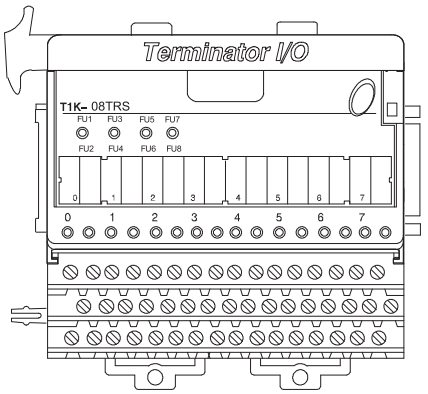


Relay Output Modules

T1K-08TRS <--->

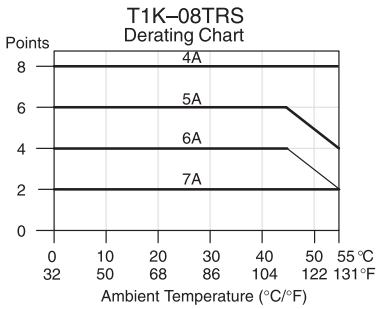
8-point, isolated relay output module

The 8-point relay output module uses a T1K-16B or T1K-16B-1 base, which is purchased separately.

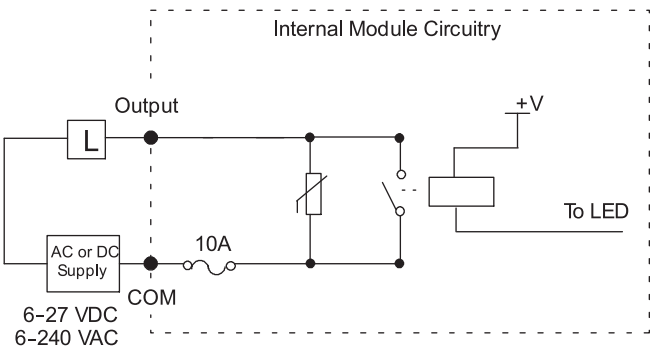


T1K-08TRS Output Specification	
Outputs per Module	8 normally open
Commons	8, 1 pt. / common (isolated)
Operating Voltage Range	6-240 VAC (47-63 Hz), 6-27 VDC
Output Voltage Range	5-264 VAC (47-63 Hz), 5-30 VDC min./max.
Max. Load Current	7A / pt. (subject to derating)
Max. Leakage Current	0.1 mA @ 264 VAC
Max. Inrush Current	8A for 10 ms
Min. Load	5 mA @ 5 VDC
OFF to ON Response	< 15 ms
ON to OFF Response	< 10 ms
Base Power Required	400 mA @ 5 VDC
Status Indicators	Logic side
Error Status Indications(LEDS)	FU1/FU2 ON = fuse 1 or 2 blown FU3/FU4 ON = fuse 3 or 4 blown FU5/FU6 ON = fuse 5 or 6 blown FU7/FU8 ON = fuse 7 or 8 blown
Fuses (User Replaceable) ***T1K-FUSE-3***	8, (10 A, 250 V / common), 1 pt. / fuse NQ3-10 SOC Corp.
Weight	185 g

Typical Relay Life (Operations)				
Voltage and Load Type	***Load Current***			
	1A	***2A***	***5A***	***7A***
24 VDC Resistive	1000 K	500 K	200 K	100 K
24 VDC Solenoid	300 K	100 K	see note	see note
110 VAC Resistive	1000 K	500 K	200 K	100 K
110 VAC Solenoid	300 K	100 K	see note	see note
220 VAC Resistive	500 K	250 K	125 K	60 K
220 VAC Solenoid	300 K	100 K	see note	see note
Note: Solenoid (inductive) loads >2A cannot be used.				



Equivalent Output Circuit

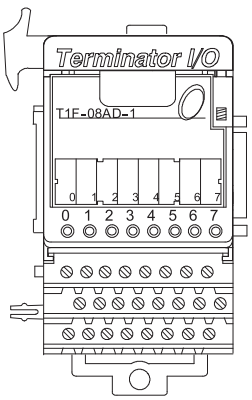


Analog Current Input Module

T1F-08AD-1 <--->

8-channel analog current input module

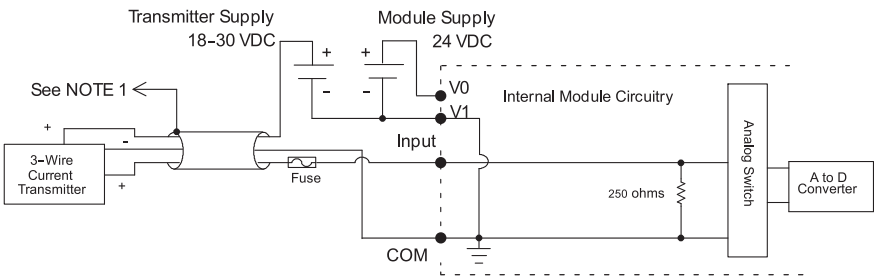
The 8-channel current input module uses a T1K-08B or T1K-08B-1 base, which is purchased separately.



T1F-08AD-1 Analog Input Specification	
Number of Channels	8, single-ended (1 common)
Input Ranges	-20 to 20 mA, 0-20 mA, 4-20 mA
Resolution	14 bit (13 bit plus sign bit)
Frequency Response	-3 db @ 500 Hz, -20 db/decade
Input Resistance	250 Ω
Absolute Max. Ratings	8V max. input
Conversion Time	Normal mode: 5 ms per channel (default); Fast mode*: 0.5 ms per channel
Linearity Error	± 2 counts max.
Input Stability	Normal mode: ± 1 count (default); Fast mode*: ± 5 counts
Full Scale Error (Offset Error Not Included)	16 counts max.
Offset Error	2 counts max.
Max. Full Scale Inaccuracy (% of full scale); All errors included	0.18% @ 25°C 0.36% @ 60°C
Master Update Rate	8 channels per scan max.
Input Points Required	256 discrete pts. or 8 Dwords (32-bit words) (Network interface dependent)
Base Power Required	75 mA @ 5 VDC
External Module Power Required	21.6-26.4 VDC, 50 mA, class 2
Recommended Fuse	0.032 A, Series 217 Fast Acting
Weight	136 g

*** Fast mode is supported in module hardware version B or later. Fast mode is only supported when using the analog module with the T1H-EBC(100) or T1H-PBC Interface module.**

Equivalent Input Circuit



NOTES:

1: Shields should be grounded at the signal source.

2: More than one external power supply can be used, provided all the power supply commons are connected.

3: A Series 217, 0.032A fast-acting fuse is recommended for 4-20 mA current loops.

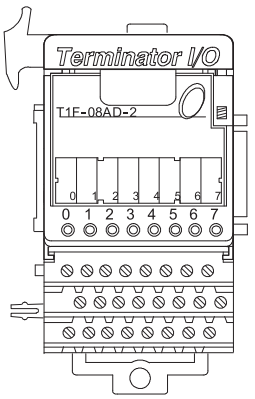
4: If the power supply common of an external power supply is not connected to the 0V terminal on the module, then the output of the external transmitter must be isolated. To avoid "ground loop" errors, recommended 4-20 mA transmitter types are:
- For 2 or 3 wire connections: Isolation between the input supply signal and the power supply.
- For 4 wire connections: Isolation between the input supply signal, the power supply and the 4-20mA output.

Analog Voltage Input Module

T1F-08AD-2 <--->

8-channel
analog voltage input module

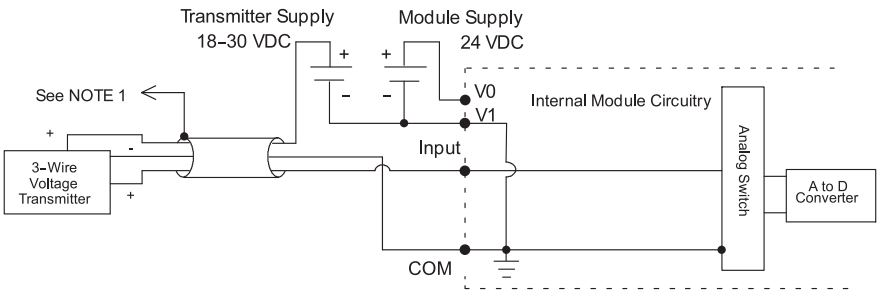
The 8-channel voltage input module uses a T1K-08B or T1K-08B-1 base, which is purchased separately.



T1F-08AD-2 Analog Input Specification	
Channels Per Module	8 single-ended (1 common)
Input Ranges	0-5 V, 0-10 V, ± 5V, ± 10V
Resolution	14 bit (13 bit plus sign bit)
Frequency Response	-3 db @ 500 Hz, -20 db/decade
Input Resistance	200 KΩ min.
Absolute Max. Ratings	Fault protected input 130 V(rms) or 100 VDC
Conversion Time	Normal mode: 5 ms per channel (default); Fast mode*: 0.5 ms per channel
Linearity Error	± 2 count max.
Input Stability	Normal mode: ± 1 count (default); Fast mode*: ± 5 counts
Calibration Full Scale Error	8 counts max.
Calibration Offset Error	2 counts max.
Max. Full Scale Inaccuracy (% of full scale); All errors included	0.08% @ 25°C 0.26% @ 60°C
Master Update Rate	8 channels per scan max.
Input Points Required	256 discrete pts. or 8 Dwords (32-bit words) (Network Interface Dependent)
Base Power Required	75 mA @ 5 VDC
External Module Power Required	21.6-26.4 VDC, 50 mA, class 2
Weight	136 g

*** Fast mode is supported in module hardware version B or later. Fast mode is only supported when using the analog module with the T1H-EBC(100) or T1H-PBC Interface module.**

Equivalent Input Circuit



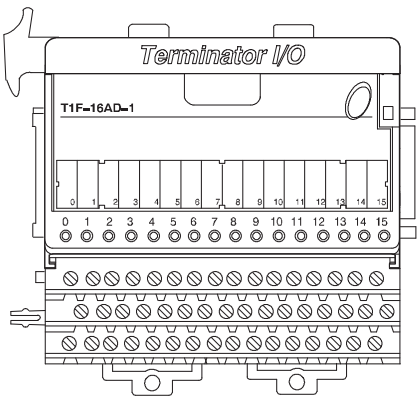
NOTES:
1: Shields should be grounded at the signal source.
2: Unused inputs should be connected to common (0 VDC).
3: More than one external power supply can be used, provided all the power supply commons are connected.

Analog Current Input Module

T1F-16AD-1 <--->

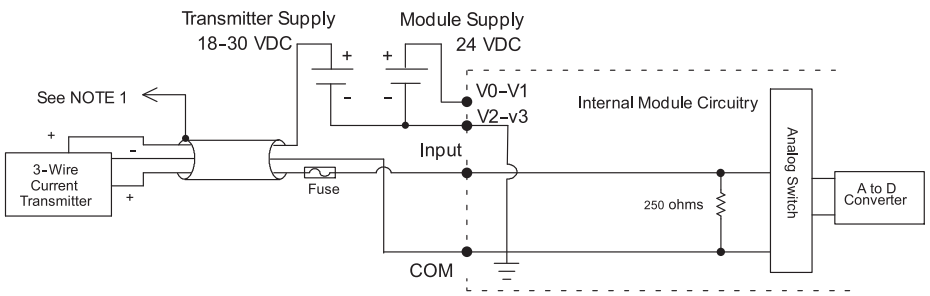
16-channel analog current input module

The 16-channel current input module uses a T1K-16B or T1K-16B-1 base, which is purchased separately.



T1F-16AD-1 Analog Input Specification	
Number of Channels	16, single ended (1 common)
Input Ranges	-20 to 20 mA, 0-20 mA, 4-20 mA
Resolution	14 bit (13 bit plus sign bit)
Frequency Response	-3 db @ 500 Hz, -20 db/decade
Input Resistance	250 Ω
Absolute Max. Ratings	8V max. input
Conversion Time	5 ms per channel
Linearity Error	± 2 counts max.
Input Stability	± 1 count
Full Scale Error (Offset Error not included)	16 counts max.
Offset Error	2 counts max.
Max. Full Scale Inaccuracy (% of full scale). All errors included	0.18% @ 25°C 0.36% @ 60°C
Master Update Rate	16 channels per scan max.
Input Points Required	512 discrete pts. or 16 Dwords (32-bit words)(network interface dependent)
Base Power Required	75 mA @ 5 VDC
External Module Power Required	21.6-26.4 VDC, 50 mA, class 2
Recommended Fuse	0.032 A, Series 217 fast acting
Weight	168 g

Equivalent Input Circuit



NOTES:

1: Shields should be grounded at the signal source.

2: More than one external power supply can be used, provided all the power supply commons are connected.

3: A Series 217, 0.032 A fast-acting fuse is recommended for 4-20 mA current loops.

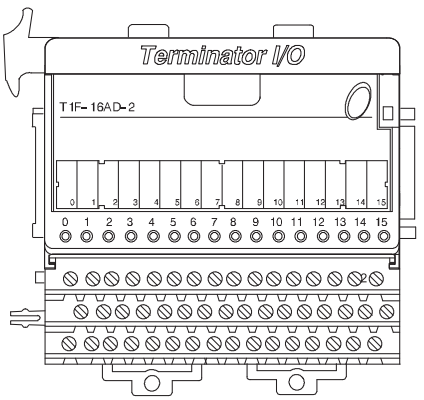
4: If the power supply common of an external power supply is not connected to the 0V terminal on the module, then the output of the external transmitter must be isolated. To avoid "ground loop" errors, recommended 4-20 mA transmitter types are:
- For 2 or 3 wire connections: Isolation between the input supply signal and the power supply.
- For 4 wire connections: Isolation between the input supply signal, the power supply and the 4-20 mA output.

Analog Voltage Input Module

T1F-16AD-2 <--->

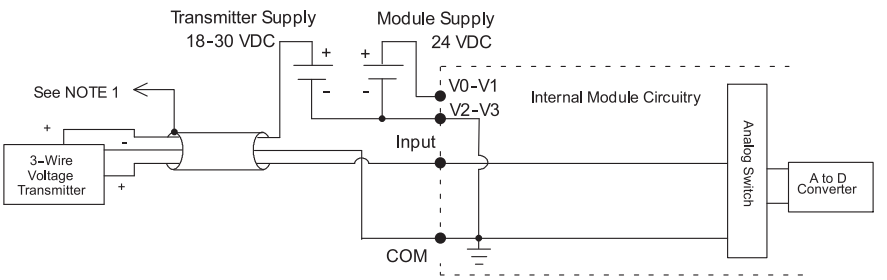
16-channel analog voltage input module

The 16-channel voltage input module uses a T1K-16B or T1K-16B-1 base, which is purchased separately.



T1F-16AD-2 Analog Input Specification	
Number of Channels	16, single ended (1 common)
Input Ranges	0-5 V, 0-10 V, ± 5V, ± 10 V
Resolution	14 bit (13 bit plus sign bit)
Frequency Response	-3 db @ 500 Hz, -20 db/decade
Input Resistance	200 KΩ min.
Absolute Max. Ratings	Fault protected input 130 V(rms) or 100 VDC
Conversion Time	5 ms per channel
Linearity Error	± 2 count max.
Input Stability	± 1 count
Calibration Full Scale Error	8 counts max.
Calibration Offset Error	2 counts max.
Max. Full Scale Inaccuracy (% of full scale). All errors included	0.08% @ 25°C 0.26% @ 60°C
Master Update Rate	16 channels per scan max.
Input Points Required	512 discrete points or 16 Dwords (32-bit words) (Network Interface Dependent)
Base Power Required	75 mA @ 5 VDC
External Module Power Required	21.6-26.4 VDC, 50 mA, class 2
Weight	160 g

Equivalent Input Circuit



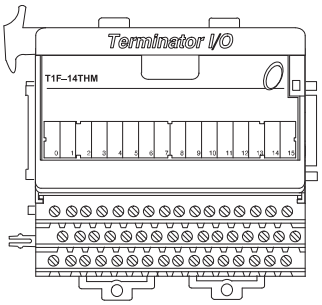
NOTES:
1: Shields should be grounded at the signal source.
2: Unused inputs should be connected to common (0 VDC).
3: More than one external power supply can be used, provided all the power supply commons are connected.

Thermocouple Input Module

T1F-14THM <--->

14-channel thermocouple input module

The 14-channel thermocouple input module uses a T1K-16B screw-type terminal base only, which is purchased separately.



T1F-14THM 14-Channel Thermocouple Input Specifications	
Use I/O Base	T1K-16B Only
Number of Channels	14, differential
Common Mode Range	±5 VDC
Common Mode Rejection	90 dB min. @ DC, 150 dB min. @ 50/60 Hz.
Input Impedance	1 MΩ
Absolute Maximum Ratings	Fault-protected inputs to ±50 VDC
Accuracy vs. Temperature	±5 ppm/°C maximum full scale calibration. (including maximum offset change)
Master Update Rate	14 channels per scan max.
Input Points Required	512 Discrete I/O points /16 Double Words Network Interface Dependent
External Module Power Required	70mA maximum, 24VDC ± 5%
Base Power Required	60 mA max., 5 VDC
Operating Temperature	32° to 140°F (0° to 60°C)
Storage Temperature	-4° to 158°F (-20° to 70°C)
Relative Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3-304
Weight	168 g

Thermocouple Specifications (Cont.)		
Input Ranges	Type J -190 to 760°C Type E -210 to 1000°C Type K -150 to 1372°C Type R 65 to 1768°C Type S 65 to 1768°C Type T -230 to 400°C Type B 529 to 1820°C Type N -70 to 1300°C Type C 65 to 2320°C	-310 to 1400°F -346 to 1832°F -238 to 2502°F 149 to 3214°F 149 to 3214°F -382 to 752°F 984 to 3308°F -94 to 2372°F 149 to 4208°F
Display Resolution	±0.1 °C or ±0.1 °F	
Cold Junction Compensation	Automatic; CJC (part #: T1F-CJC) included with module must be installed in terminal base (refer to the module's data sheet)	
Conversion Time	100 ms	
Warm-Up Time	30 minutes typically ± 1°C repeatability	
Linearity Error (End to End)	±.05 °C maximum, ±.01°C typical	
Maximum Inaccuracy	±3 °C (excluding thermocouple error)	
Voltage Input Specifications		
Voltage Ranges	0-5 V, ±5V, 0-156.25 mV, ±156.25 mVDC	
Resolution	16 bit (1 in 65535)	
Full Scale Calibration Error (Offset Error Included)	±13 counts typical ±33 maximum	
Offset Calibration Error	±1 count maximum, @ 0V input	
Linearity Error (End to End)	±1 count maximum	
Maximum Inaccuracy	±.0.02% @ 25°C (77°F)	

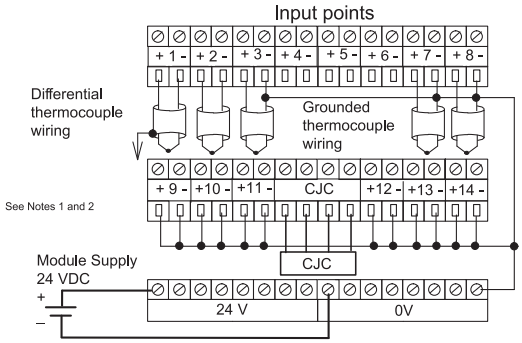
Notes:

1: Shields should be grounded at the signal source.

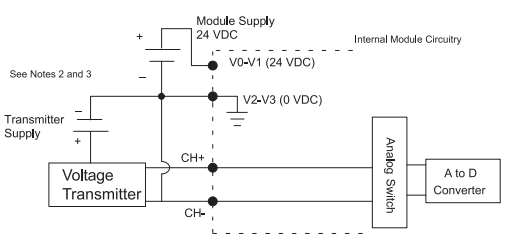
2: Connect unused inputs to a common terminal (0 VDC).

3: When using 0-156 mV and 5V ranges, connect (-) or (0) volts terminal to 0V to ensure common mode range acceptance.

4: The Cold Junction Compensation (CJC) temperature sensing unit must be installed into the I/O base terminals to perform CJC of the thermocouple inputs.



Equivalent Input Circuit

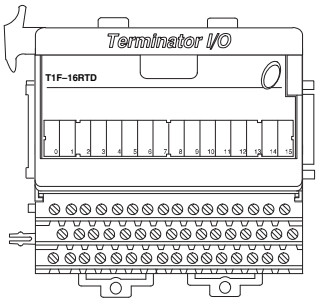


RTD Input Module

T1F-16RTD <--->

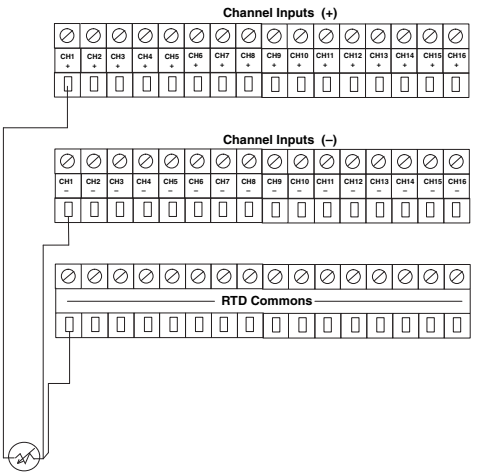
16-channel
RTD input module

The 16-channel RTD input module uses a T1K-16B or T1K-16B-1 base, which is purchased separately.



T1F-16RTD 16-Channel RTD Input Specifications	
Number of Channels	16
Common Mode Range	0-5 VDC
Resolution	± 0.1 °C or °F
Notch Filter	>50db notches @ 50/60 Hz; f - 3db = 13.1 Hz
Absolute Maximum Ratings	±50 VDC
Converter Type	Charge balancing, 24-bit
Master Update Rate	16 channels per scan max.
Input Points Required	512 Discrete I/O points /16 Double Words Network Interface Dependent
Sampling Rate	140ms / channel
Base Power Required	150 mA max., 5 VDC
Temperature Drift	25 ppm / °C (max.)
Maximum Inaccuracy	± 1 °C
RTD Excitation Current	200 µA
Operating Temperature	32° to 140°F (0° to 60°C)
Storage Temperature	-4° to 158°F (-20° to 70°C)
Relative Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3-304
Weight	168 g

RTD Input Ranges		
Input Ranges	Pt100 -200 to 850°C	-328 to 1562°F
	Pt1000 -200 to 595°C	-328 to 1103°F
	Pt100 -38 to 450°C	-36 to 842°F
	Type CU 10 -200°C to 260°C	-328 to 500°F
	Type CU 25 -200°C to 260°C	-328 to 500°F
	120 Ω Nickel -80 to 260°C	-112 to 500°F

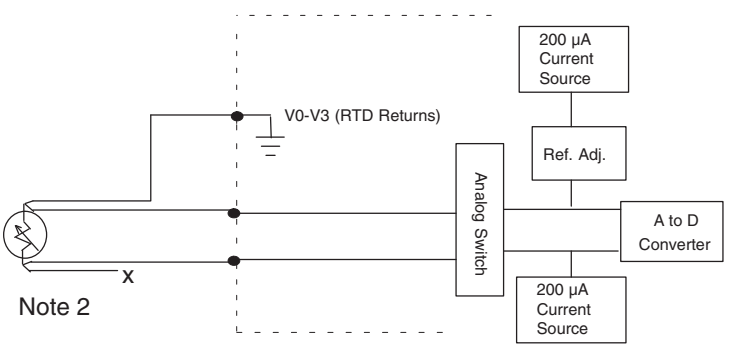


Notes:

1: The three wires connecting the RTD to the module must be the same type and length. Do not use the shield or drain wire for the third connection.

2: If an RTD sensor has four wires, the plus sense wire should be left unconnected as shown.

Equivalent Input Circuit

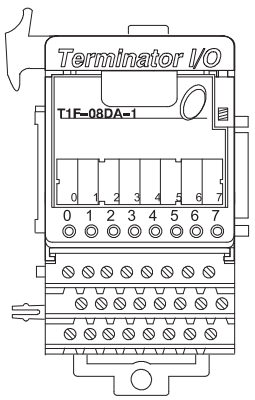


Analog Current Output Module

T1F-08DA-1 <--->

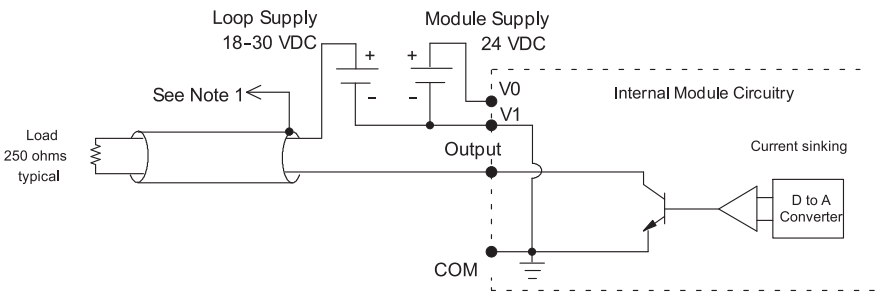
8-channel analog current output module

The 8-channel current output module uses a T1K-08B or T1K-08B-1 base, which is purchased separately.



T1F-08DA-1 Analog Output Specification	
Channels Per Module	8
Output Ranges	0-20 mA, 4-20 mA
Output Type	Single-ended, 1 common
Resolution	12 bit (1 in 4096)
Max. Loop Supply	30 VDC
Peak Output Voltage	30 VDC
Load Impedance	0Ω min.
Max. Load (ohm) / Power Supply	620/18 V, 910/24 V, 1200/30 V
Min. Load (ohm) / Power Supply	0/24 V, 350/30 V @ 40°C 250/24V, 600/30 V @ 60°C
Linearity Error (end to end)	± 2 counts max. ± 0.05% of full scale max.
Conversion Settling Time	400 µs max. full scale change
Full Scale Calibration Error	± 12 counts max.
Offset Calibration Error	0-20 mA: ± 6 counts max. 4-20 mA: ± 6 counts max.
Accuracy vs. Temperature	± 50 ppm/°C full scale calibration change
Max. Full Scale Inaccuracy (% of full scale); all errors included	0.2% @ 25°C 0.4% @ 60°C
Master Update Rate	8 channels per scan max.
Output Points Required	256 discrete pts. or 8 Dwords (32-bit words) (network interface dependent)
Base Power Required	75 mA @ 5 VDC
External Module Power Required	21.6-26.4 VDC, 150 mA, class 2
Weight	145 g

Equivalent Output Circuit



NOTES:

1: Shields should be connected to the 0V terminal of the module or the 0V of the power supply.

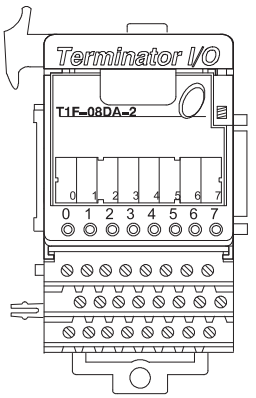
2. Unused current outputs should remain open (no connections) for minimum power consumption.

Analog Voltage Output Module

T1F-08DA-2 <--->

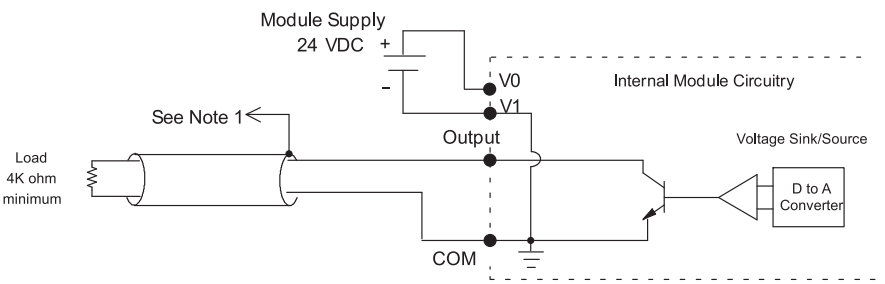
8-channel
analog voltage output module

The 8-channel voltage output module uses a T1K-08B or T1K-08B-1 base, which is purchased separately.



T1F-08DA-2 Analog Output Specification	
Number of Channels	8
Output Ranges	0-5V, 0-10V, ± 5V, ± 10V
Output Type	Single-ended, 1 common
Resolution	12 bit (1 in 4096)
Peak Output Voltage	15VDC
Load Impedance	4KΩ min.
Load Capacitance	0.01µF max.
Linearity Error (end to end)	± 2 counts max. ± 0.05% of full scale max.
Conversion Settling Time	100 µs max. full scale change
Full Scale Calibration Error	± 12 counts max.
Offset Calibration Error	10 V ranges: ± 6 counts max. 5V ranges: ± 11 counts max.
Accuracy vs. Temperature	± 50 ppm/°C full scale calibration change
Max. Full Scale Inaccuracy (% of full scale). all errors included	10V ranges: 0.2% @ 25°C 0.4% @ 60°C 5V ranges: 0.3% @ 25°C 0.5% @ 60°C
Master Update Rate	8 channels per scan max.
Output Points Required	256 discrete pts. or 8 Dwords (32-bit words) (network interface dependent)
Base Power Required	75 mA @ 5 VDC
External Module Power Required	21.6-26.4 VDC, 150 mA, class 2
Weight	145 g

Equivalent Output Circuit



NOTES:

1: Shields should be connected to the 0V terminal of the module or the 0V of the power supply.

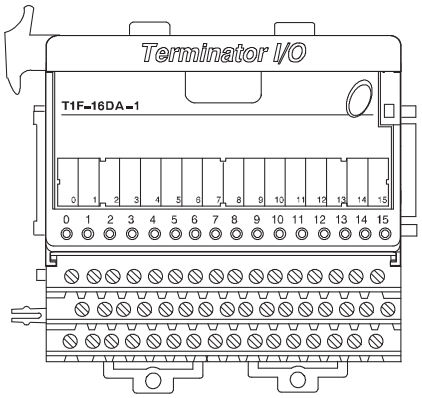
2. Unused current outputs should remain open (no connections) for minimum power consumption.

Analog Current Output Module

T1F-16DA-1 <--->

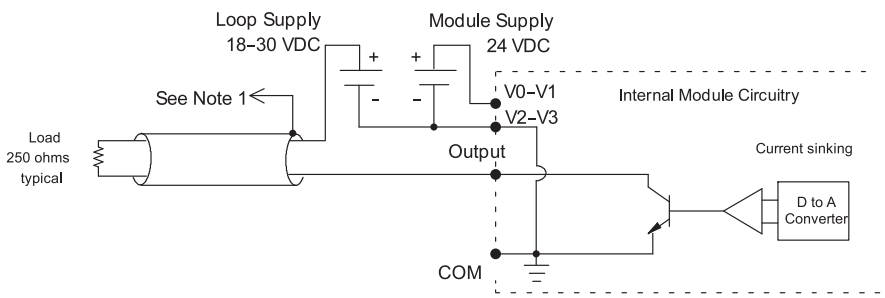
16-channel analog current output module

The 16-channel current output module uses a T1K-16B or T1K-16B-1 base, which is purchased separately.



T1F-16DA-1 Analog Output Specification	
Number of Channels	16
Output Ranges	0-20 mA, 4-20 mA
Output Type	Single-ended, 1 common
Resolution	12 bit (1 in 4096)
Max. Loop Supply	30 VDC
Peak Output Voltage	30 VDC
Max. Load (Ω) / Power Supply	620/18 V, 910/24 V, 1200/30 V
Min. Load (Ω) / Power Supply	0/24 V, 350/30 V, @ 40°C 250/24 V, 600/30 V @ 60°C
Linearity Error (end to end)	± 2 counts max. ± 0.05% of full scale max.
Conversion Settling Time	100 µs max. full scale change
Full Scale Calibration Error	± 12 counts max.
Offset Calibration Error	± 4 counts max.
Accuracy vs. Temperature	± 50 ppm/°C full scale calibration change
Max. Full Scale Inaccuracy (% of full scale), All errors included	0.2% @ 25°C 0.4% @ 60°C
Master Update Rate	16 channels per scan max.
Output Points Required	512 discrete points or 16 Dwords (32-bit words) (network interface dependent)
Base Power Required	75 mA @ 5 VDC
External Power Supply	21.6-26.4 VDC, 150 mA, class 2
Weight	172 g

Equivalent Output Circuit



NOTES:

1: Shields should be connected to the 0V terminal of the module or the 0V of the power supply.

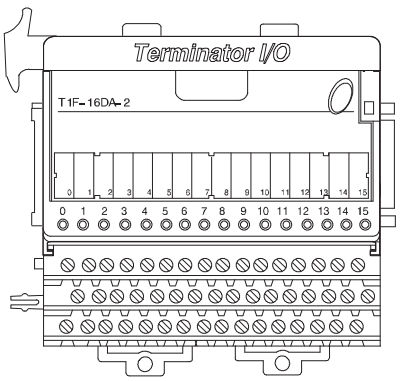
2. Unused current outputs should remain open (no connections) for minimum power consumption.

Analog Voltage Output Module

T1F-16DA-2 <--->

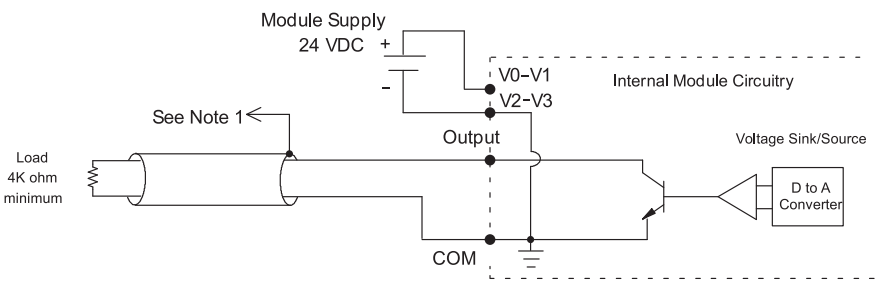
16-channel analog voltage output module

The 16-channel voltage output module uses a T1K-16B or T1K-16B-1 base, which is purchased separately.



T1F-16DA-2 Analog Output Specification	
Number of Channels	16
Output Ranges	0-5V, 0-10 V, ± 5V, + / - 10V
Output Type	Single-ended, 1 common
Resolution	12 bit (1 in 4096)
Peak Output Voltage	15 VDC
Load Impedance	4 KΩ min.
Load Capacitance	0.01 µF max.
Linearity Error (end to end)	± 2 counts max. ± 0.05% of full scale max.
Conversion Settling Time	100 µs max. full scale change
Full Scale Calibration Error	± 12 counts max.
Offset Calibration Error	10 V ranges: ± 6 counts max. 5V ranges: ± 11 counts max.
Accuracy vs. Temperature	± 50 ppm/°C full scale calibration change
Max. Full Scale Inaccuracy (% of full scale), All errors included	10V ranges: ± 0.2% @ 25°C ± 0.4% @ 60°C 5V ranges: ± 0.3% @ 25°C ± 0.5% @ 60°C
Master Update Rate	16 channels per scan max.
Output Points Required	512 discrete points or 16 Dwords (32-bit words) (Network Interface Dependent)
Base Power Required	75 mA @ 5 VDC
External Power Supply	21.6-26.4 VDC, 150 mA, class 2
Weight	172 g

Equivalent Output Circuit



NOTES:

1: Shields should be connected to the 0V terminal of the module or the 0V of the power supply.

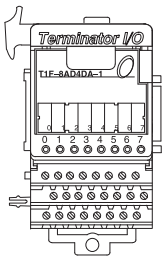
2. Unused current outputs should remain open (no connections) for minimum power consumption.

Analog Current Combination Module

T1F-8AD4DA-1 <--->

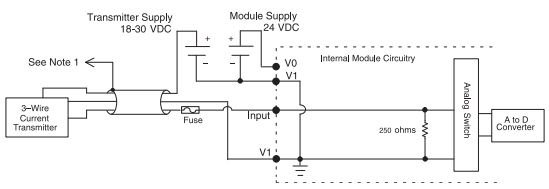
8-channel analog current input
4-channel analog current output

The combination 8-in and 4-out current module uses a T1K-8B or T1K-8B-1 base, which is purchased separately.



T1F-8AD4DA-1 Analog Input Specification	
Number of Channels	8, single-ended (1 common)
Input Ranges	-20 to 20 mA, 0-20 mA, 4-20 mA
Resolution	14 bit (13 bit plus sign bit)
Frequency Response	-3db @ 500Hz, -20db/decade
Input Resistance	250Ω
Absolute Max. Ratings	8V max. input
Conversion Time	5ms per channel
Linearity Error	± 2 counts max.
Input Stability	± 1 count
Full Scale Error (Offset Error not included)	16 counts max.
Offset Error	2 counts max.
Max. Full Scale Inaccuracy (% of full scale), all errors included	0.18% @ 25°C 0.36% @ 60°C
Master Update Rate	8 channels per scan max.
Input Points Required	256 discrete pts. or 8 Dwords (32-bit words) (Network Interface Dependent)
Base Power Required	75mA @ 5 VDC
External Power Required	21.6-26.4 VDC, 60mA, class 2 (plus 20mA per output loop)
Recommended Fuse	0.032 A, Series 217 Fast Acting
Weight	136 g

Equivalent Input Circuit



NOTES:

1: Shields should be grounded at the signal source.

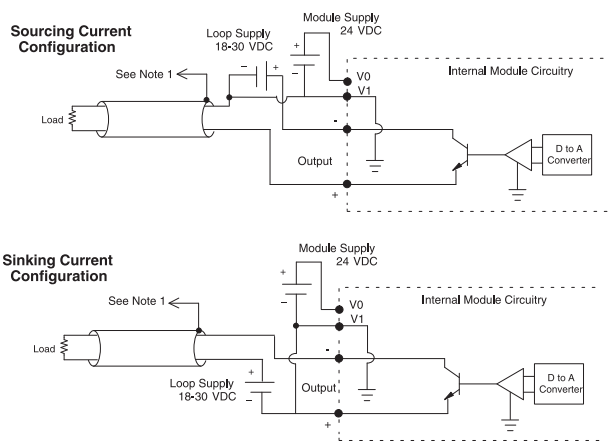
2: More than one external power supply can be used, provided all the power supply commons are connected.

3: A Series 217, 0.032A fast-acting fuse is recommended for 4-20 mA current loops.

4: If the power supply common of an external power supply is not connected to the 0V terminal on the module, then the output of the external transmitter must be isolated. To avoid "ground loop" errors, recommended 4-20 mA transmitter types are:
- For 2 or 3 wire connections: Isolation between the input supply signal and the power supply.
- For 4 wire connections: Isolation between the input supply signal, the power supply and the 4-20 mA output.

Analog Output Specification	
Channels Per Module	4, sink/source by wiring
Output Ranges	4-20 mA
Output Type	Single-ended, 1 common
Resolution	12 bit (1 in 4096)
Max. Loop Supply	30 VDC
Source Load / Loop Power Supply	0-400 Ω / 18-30 VDC
Sink Load / Loop Power Supply	0-600 Ω / 18 VDC 0-900 Ω / 24 VDC 0-1200 Ω / 30 VDC
Total Load (Sink + Source)	600 Ω/18V, 900 Ω/24V, 1200 Ω/30V
Linearity Error (End to End)	± 2 counts max. ± 0.05% of full scale max.
Conversion Settling Time	400 µs max. full scale change
Full Scale Calibration Error (Note: source error depends upon the load from the source terminal to ground)	SINK: ± 12 counts max. @ any load SOURCE: ± 26 counts max. @ 400 Ω ± 18 counts max. @ 250 Ω ± 12 counts max. @ 125 Ω
Offset Calibration Error	SINK: ± 6 counts max. @ any load SOURCE: ± 10 counts max. @ 400 Ω ± 8 counts max. @ 250 Ω ± 6 counts max. @ 125 Ω
Max. Full Scale Inaccuracy (% of Full Scale) All Errors Included	SINK: (any load) 0.3% @ 25°C (any load) 0.5% @ 60°C SOURCE: 400 Ω load 0.63% @ 25°C 400 Ω 0.83% @ 60°C 250 Ω 0.44% @ 25°C 250 Ω load 0.64% @ 60°C 125 Ω load 0.30% @ 25°C 125 Ω load 0.50% @ 60°C
Master Update Rate	4 channels per scan max.
Output Points Required	128 discrete pts. or 4 Dwords (32-bit words) (network interface dependent)

Equivalent Output Circuit



NOTES:

1: Shields should be connected to the 0V terminal of the module or the 0V of the power supply.

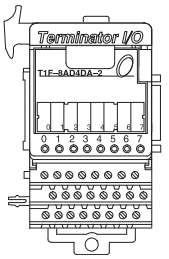
2. Unused current outputs should remain open (no connections) for minimum power consumption.

Analog Voltage Combination Module

T1F-8AD4DA-2 <--->

8-channel analog voltage input
4-channel analog voltage output

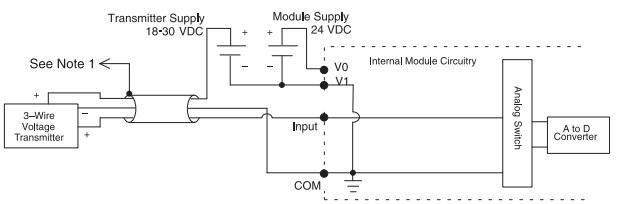
The combination 8-in and 4-out voltage module uses a T1K-8B or T1K-8B-1 base, which is purchased separately.



T1F-8AD4DA-2 Analog Input Specification	
Channels Per Module	8 single-ended (1 common)
Input Ranges	0-5V, 0-10 V, ± 5V, ± 10 V
Resolution	14 bit (13 bit plus sign bit)
Frequency Response	-3db @ 500 Hz, -20 db/decade
Input Resistance	200 KΩ min.
Absolute Max. Ratings	Fault Protected Input 130V(rms) or 100 VDC
Conversion Time	5.5ms per channel
Linearity Error	± 2 count max.
Input Stability	± 1 count
Calibration Full Scale Error	8 counts max.
Calibration Offset Error	2 counts max.
Max. Full Scale Inaccuracy (% of full scale), all errors included	0.08% @ 25°C 0.26% @ 60°C
Master Update Rate	8 channels per scan max.
Input Points Required	256 discrete pts. or 8 dwords (32-bit words) (Network Interface Dependent)
Base Power Required	75 mA @ 5 VDC
External Power Supply	21.6-26.4 VDC, 70 mA, class 2
Weight	136 g

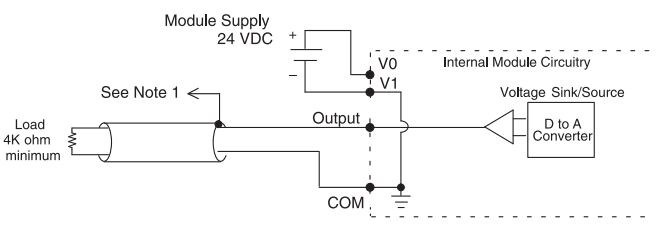
T1F-8AD4DA-2 Analog Output Specification	
Number of Channels	4
Output Ranges	0-5V, 0-10 V, ± 5V, ± 10V
Output Type	single ended, 1 common
Resolution	12 bit (1 in 4096)
Peak Output Voltage	15 VDC
Load Impedance	4 KΩ min.
Load Capacitance	0.01 µF max.
Linearity Error (End to End)	± 2 counts max. ± 0.05% of full scale max.
Conversion Settling Time	300 µs max. full scale change
Full Scale Calibration Error	± 12 counts max.
Offset Calibration Error	10 V ranges: ± 5 counts max. 5V ranges: ± 9 counts max.
Accuracy vs. Temperature	± 50 ppm/°C full scale calibration change
Max. Full Scale Inaccuracy (% of full scale) All errors and temp drift included	10V ranges: ± 0.2% @ 25°C ± 0.4% @ 60°C 5V ranges: ± 0.3% @ 25°C ± 0.5% @ 60°C
Master Update Rate	4 channels per scan max.
Output Points Required	128 discrete pts. or 4 Dwords (32-bit words) (Network Interface Dependent)

Equivalent Input Circuit



NOTES:
1: Shields should be grounded at the signal source.
2: Unused inputs should be connected to common (0 VDC).
3: More than one external power supply can be used, provided all the power supply commons are connected.

Equivalent Output Circuit



NOTES:
1: Shields should be connected to the 0V terminal of the module or the 0V of the power supply.
2. Unused current outputs should remain open (no connections) for minimum power consumption.