3

I/O Wiring and Specifications

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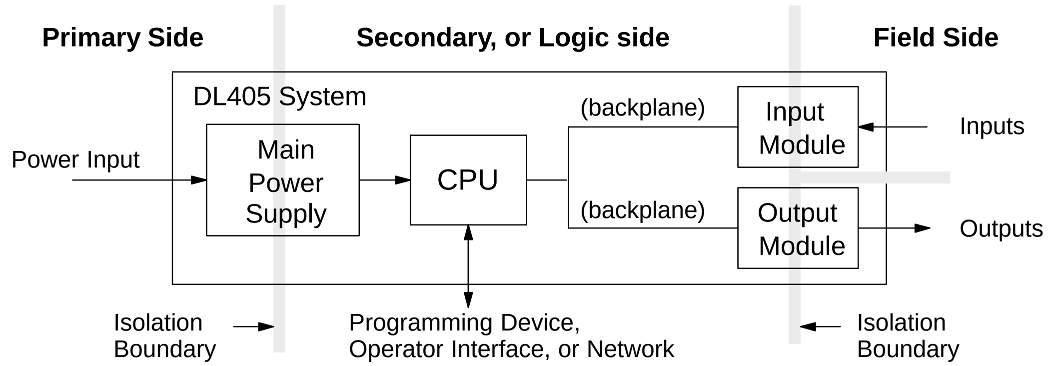
- — I/O Module Wiring and Specifications
- — Glossary of Specification Terms
- — I/O Module Wiring diagrams

I/O Wiring Strategies

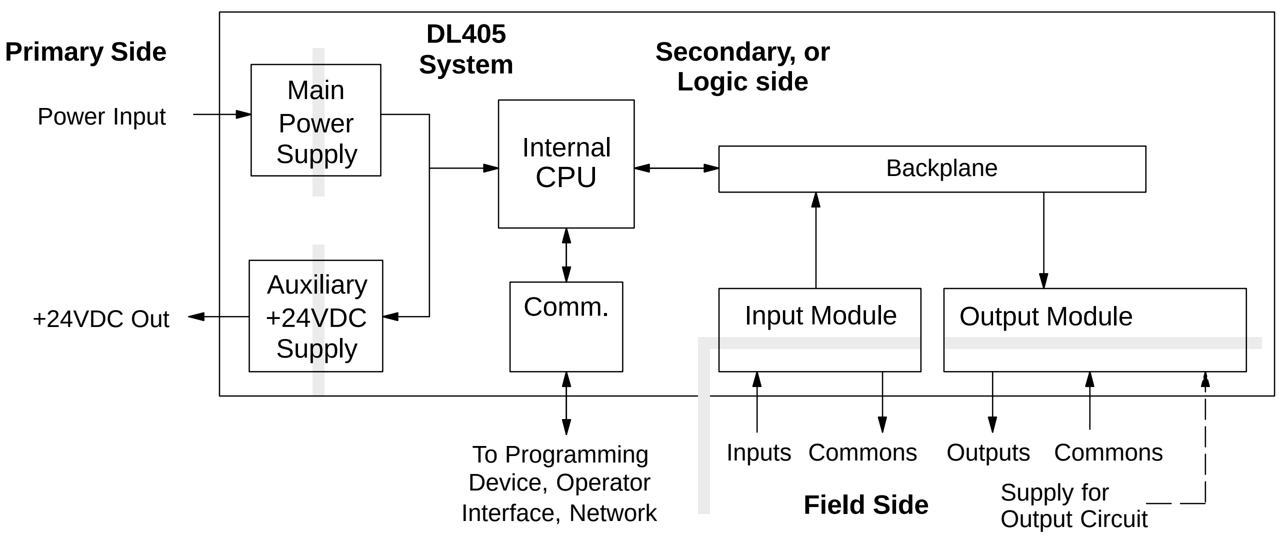
The DL405 system is very flexible and will work in many different wiring configurations. By studying this section before actual installation, you should find the best wiring strategy for your application . This will help to lower system cost, wiring errors, and avoid safety problems.

DL405 System Isolation Boundaries

DL405 system circuitry is divided into three main regions separated by isolation boundaries, shown in the drawing below. Electrical isolation provides safety, so that a fault in one area does not damage another. A transformer in the power supply provides magnetic isolation between the primary and secondary sides. Opto-couplers provide optical isolation in Input and Output circuits. This isolates logic circuitry from the field side, where factory machinery connects. Note that the discrete inputs are isolated from the discrete outputs, because each is isolated from the logic side. Isolation boundaries protect the operator interface (and the operator) from power input faults or field wiring faults. *When wiring a DL405 system, it is extremely important to avoid making external connections that connect logic side circuits to any other.*



The next figure shows the physical layout of a DL405 system, as viewed from the front. In addition to the basic circuits covered above, AC-powered units include an auxiliary +24VDC power supply with its own isolation boundary. Since the supply output is isolated from the other three circuits, it can power input and/or output circuits!

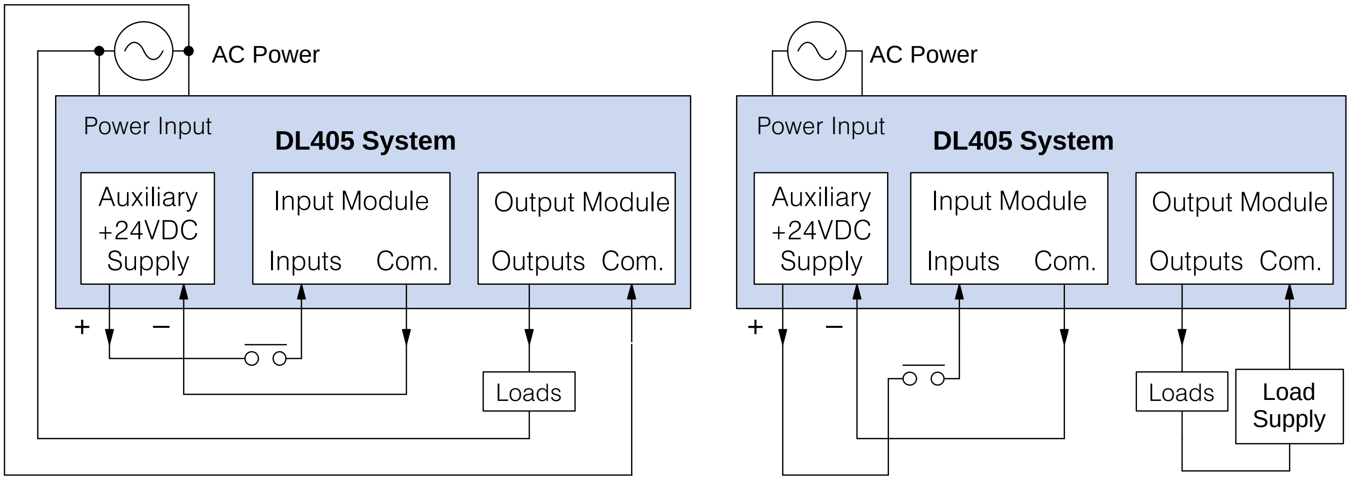


In some cases, using the built-in auxiliary +24VDC supply can result in a cost savings for your control system. It can power combined loads up to 400 mA. Be careful not to exceed the current rating of the supply. If you are the system designer for your application, you may be able to select and design in field devices which can use the +24VDC auxiliary supply.

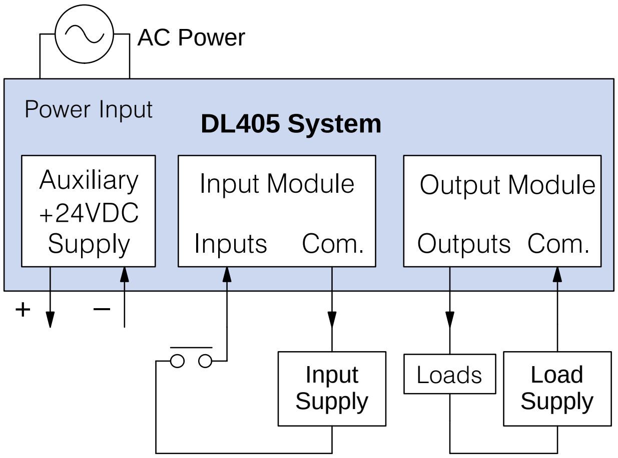
Powering I/O Circuits Using Separate Supplies

In most applications it will be necessary to power the input devices from one power source, and to power output loads from another source. Loads often require high-energy AC power, while input sensors use low-energy DC. If a machine operator is likely to come in close contact with input wiring, then safety reasons also require isolation from high-energy output circuits. It is most convenient if the loads can use the same power source as the DL405 system, and the input sensors can use the auxiliary supply, as shown to the left in the figure below.

If the loads cannot be powered from the system supply, then a separate supply must be used as shown to the right in the figure below.



A worst-case scenario, from a cost and complexity view-point, is an application which requires separate power sources for the DL405 system, input devices, and output loads. The example wiring diagram below on the right shows how this can work, but also that the auxiliary supply output is an unused resource.



Sinking / Sourcing Concepts

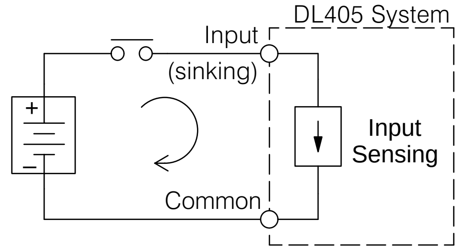
This next section helps to provide a solid understanding of "*sinking*" and "*sourcing*" concepts. Use of these terms occurs frequently in input or output circuit discussions. It is the goal of this section to make these concepts easy to understand, further ensuring success in installation.

Sinking = provides a path to supply **ground (–)**

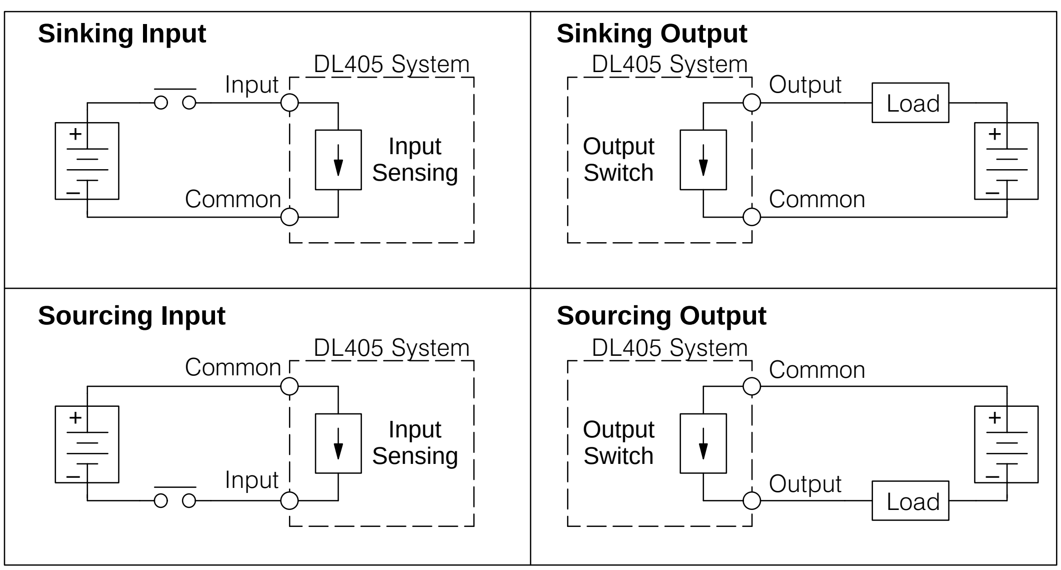
Sourcing = provides a path to supply **source (+)**

Sinking and sourcing terminology only applies to DC input and output circuits because of the reference to (+) and (–) polarities. Input and output points that are sinking or sourcing *only* can conduct current in only one direction. This means it is possible to connect the external supply and field device to the I/O point with current trying to flow in the wrong direction, and the circuit will not operate. However, you can successfully connect the supply and field device every time by understanding "sourcing" and "sinking".

For example, the figure to the right illustrates a "sinking" input. To properly connect the external supply, we just have to connect it so the input *provides a path to ground (–)*. Start at the DL405 system input terminal, follow through the input sensing circuit, exit at the common terminal, and connect the supply (–) to the common terminal. By adding the switch, between the supply (+) and the input, we have completed the circuit. Current flows in the direction of the arrow when the switch is closed.

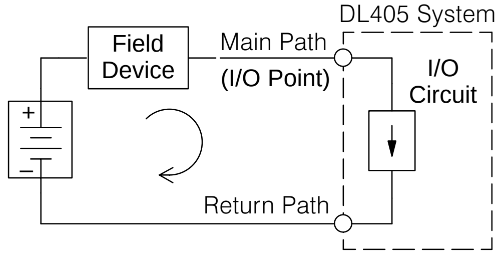


By applying the circuit principle above to the four possible combinations of input/output sinking/sourcing types, you have the four circuits as shown below. The I/O module specifications at the end of this chapter list the input or output type.

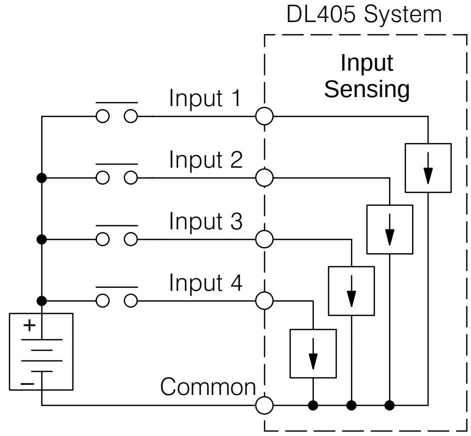


I/O "Common" Terminal Concepts

In order for an I/O circuit to operate, current must enter at one terminal and exit at another. This means at least two terminals are associated with every I/O point. In the figure to the right, the Input or Output terminal is the *main path* for the current. One additional terminal must provide the *return path* to the power supply.



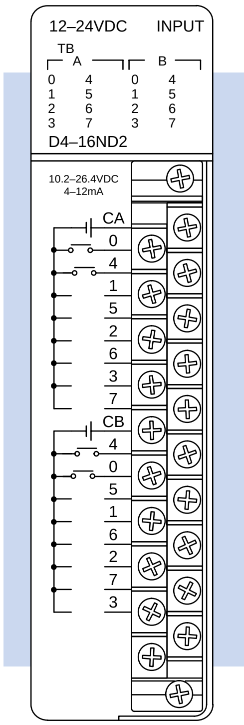
If there was unlimited space and budget for I/O terminals, then every I/O point could have two dedicated terminals as the figure above shows. However, providing this level of flexibility is not practical or even necessary for most applications. Most Input or Output points are in groups which share the return path (called *commons*). The figure to the right shows a group (or *bank*) of 4 input points which share a common return path. In this way, the four inputs require only five terminals instead of eight.

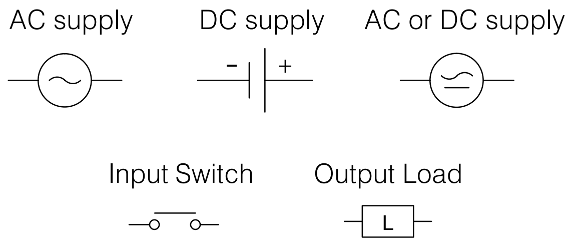


NOTE: In the circuit above, the current in the common path is 4 times any channel's input current when all inputs are energized. This is important in output circuits where heavier gauge wire is sometimes necessary on commons.

Most DL405 input and output modules group their I/O points into banks that share a common return path. The best indication of I/O common grouping is on the wiring label, such as the one shown to the right. The miniature schematic shows two circuit banks with eight input points in each. The common terminal for each is labeled "CA" and "CB", respectively.

In the wiring label example, the positive terminal of a DC supply connects to the common terminals. Some symbols you will see on the wiring labels, and their meanings are:



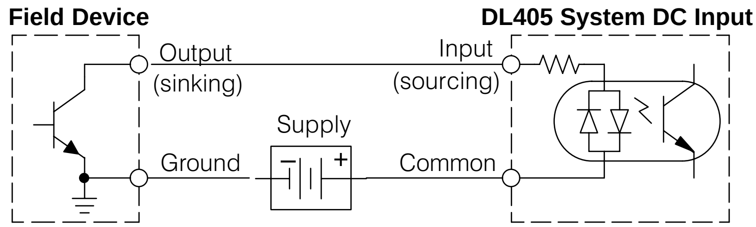


Connecting DC I/O to "Solid State" Field Devices

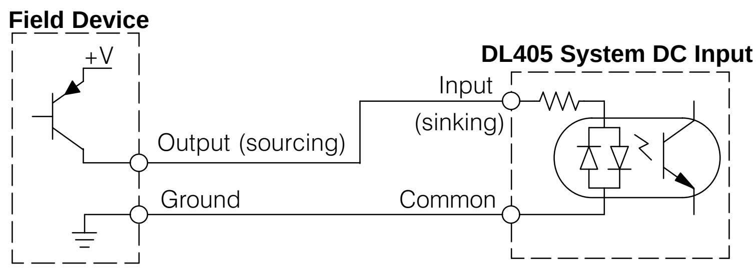
In the previous section on Sourcing and Sinking concepts, we explained that DC I/O circuits sometimes will only allow current to flow one way. This is also true for many of the field devices which have solid-state (transistor) interfaces. In other words, field devices can also be sourcing or sinking. *When connecting two devices in a series DC circuit, one must be wired as sourcing and the other as sinking*.

Solid State Input Sensors

Several DL405 DC input modules are flexible in that they detect current flow in either direction, so they can be wired as either sourcing or sinking. In the following circuit, a field device has an open-collector NPN transistor output. It sinks current from the input point, which sources current. The power supply can be the +24 auxiliary supply or another supply (+12 VDC or +24VDC), as long as the input specifications are met.



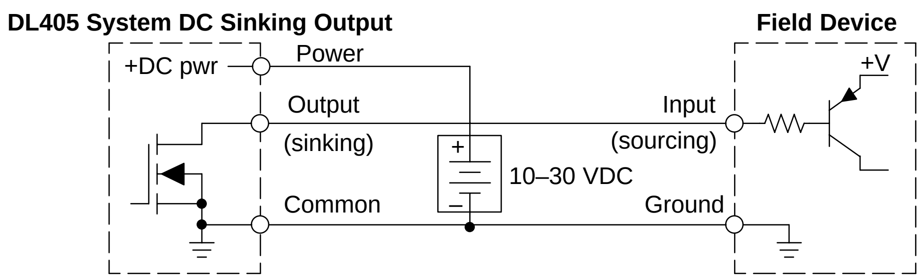
In the next circuit, a field device has an open-emitter PNP transistor output. It sources current to the input point, which sinks the current back to ground. Since the field device is sourcing current, no additional power supply is required.



Solid State Output Loads

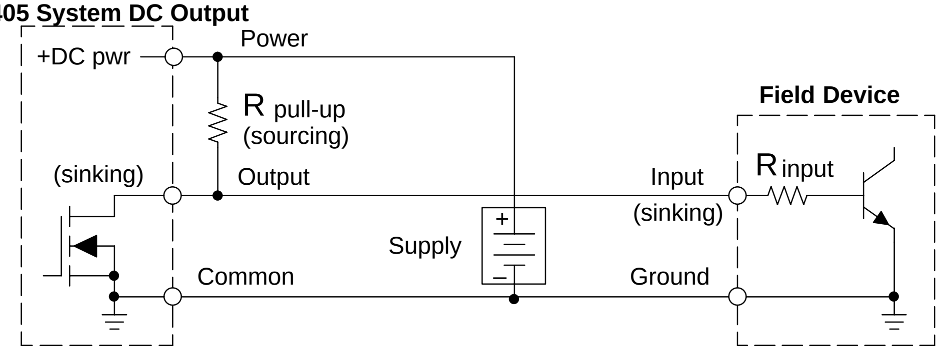
Sometimes an application requires connecting an output point to a solid state input on a device. This type of connection is usually made to carry a low-level control signal, not to send DC power to an actuator.

Several of the DL405 DC output modules are the sinking type. This means that each DC output provides a path to ground when it is energized. In the following circuit, the output point sinks current to the output common when energized. It is connected to a sourcing input of a field device input.



In the next example a sinking DC output point is connected to the sinking input of a field device. This is different, because both the DL405 system output and field device input are sinking type. Since the circuit must have one sourcing and one sinking device, a sourcing capability is added to the system output by using a pull-up resistor. In the circuit below, connect $R_{pull\text{-}up}$ from the output to the DC output circuit power input.

DL405 System DC Output



NOTE 1: DO NOT attempt to drive a heavy load (>25 mA) with this pull-up method
NOTE 2: Using the pull-up resistor to implement a sourcing output has the effect of inverting the output point logic. In other words, the field device input is energized when the DL405 system output is OFF, from a ladder logic point-of-view. Your ladder program must comprehend this and generate an inverted output. Or, you may choose to cancel the effect of the inversion elsewhere, such as in the field device.

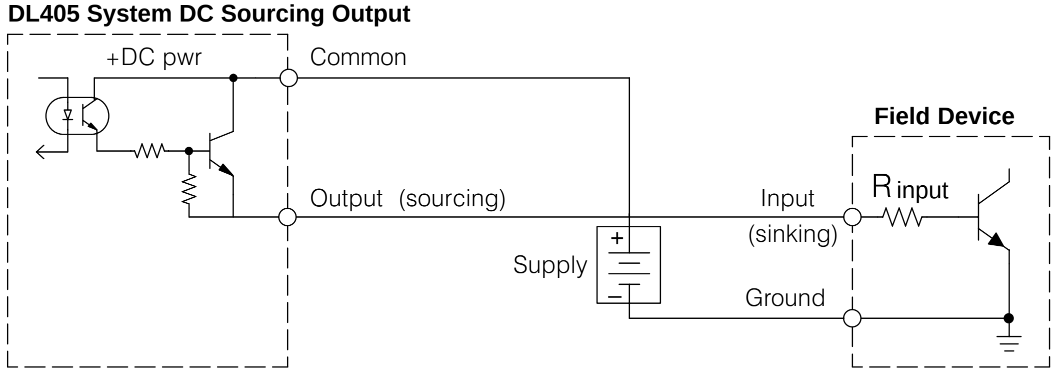
It is important to choose the correct value of $R_{pull\text{-}up}$. In order to do so, the nominal input current to the field device (I_{input}) when the input is energized needs to be identified. If this value is not known, it can be calculated as shown (a typical value is 15 mA). Then use I_{input} and the voltage of the external supply to compute $R_{pull\text{-}up}$. Next calculate the power $P_{pull\text{-}up}$ (in watts), in order to size $R_{pull\text{-}up}$ properly.

$$I_{input} = \frac{V_{input\ (turn\text{-}on)}}{R_{input}}$$

$$R_{pull\text{-}up} = \frac{V_{supply} - 0.7}{I_{input}} - R_{input} \qquad P_{pull\text{-}up} = \frac{{V_{supply}}^2}{R_{pullup}}$$

The easiest way to drive a sinking input field device as shown below is to use a DC sourcing output module. The Darlington NPN stage will have about 1.5 V ON-state saturation, but this is not a problem with low-current solid-state loads.

DL405 System DC Sourcing Output



Relay Output Guidelines

Four output modules in the DL405 I/O family feature relay outputs: D4–08TR, F4–08TRS–1, F4–08TRS–2, D4–16TR. Relays are best for the following applications:

- Loads that require higher currents than the solid-state outputs can deliver
- Cost-sensitive applications
- Some output channels need isolation from other outputs (such as when some loads require different voltages than other loads)

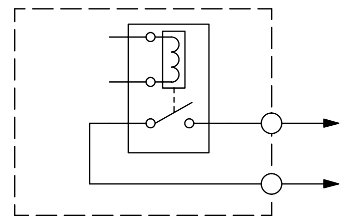
Some applications in which NOT to use relays:

- Loads that require currents under 10 mA
- Loads which must be switched at high speed or heavy duty cycle

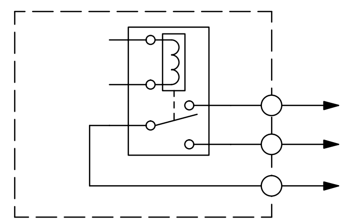
Relay outputs in the DL405 output modules are available in two contact arrangements, shown to the right. The Form A type, or SPST (single pole, single throw) type is normally open and is the simplest to use. The Form C type, or SPDT (single pole, double throw) type has a center contact which moves and a stationary contact on either side. This provides a normally closed contact and a normally open contact.

Some relay output module's relays share common terminals, which connect to the wiper contact in each relay of the bank. Other relay modules have relays which are completely isolated from each other. In all cases, the module drives the relay coil when the corresponding output point is on.

Relay with Form A contacts



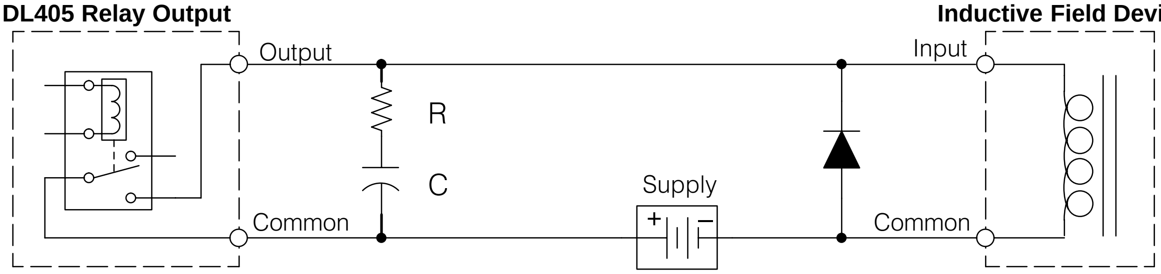
Relay with Form C contacts



Prolonging Relay Contact Life

Relay contacts wear according to the amount of relay switching, amount of spark created at the time of open or closure, and presence of airborne contaminants. However, there are some steps you can take to help prolong the life of relay contacts:

- Switch the relay on or off only when the application requires it.
- If you have the option, switch the load on or off at a time when it will draw the least current.
- Take measures to suppress inductive voltage spikes from inductive DC loads such as contactors and solenoids (circuit given below).



Adding external contact protection may extend relay life beyond the number of contact cycles listed in the specification tables for relay modules. High current inductive loads such as clutches, brakes, motors, direct-acting solenoid valves, and motor starters will benefit the most from external contact protection.

The RC network must be located close to the relay module output connector. To find the values for the RC snubber network, first determine the voltage across the contacts when open, and the current through them when closed. If the load supply is AC, then convert the current and voltage values to peak values:

$$C(\mu F) = \frac{I^2}{10} \qquad R(\Omega) = \frac{V}{10 \times I^x}, \text{ where } x = 1 + \frac{50}{V}$$

C minimum = 0.001 μF, the voltage rating of C must be ≥ V, non-polarized

R minimum = 0.5 Ω, 1/2 W, tolerance is ± 5%

For example; a relay contact drives a load at 120VAC, 1/2 A. Since this example has an AC power source, first, calculate the peak values:

$$I_{peak} = I_{rms} \times 1.414, = 0.5 \times 1.414 = 0.707 \text{ Amperes}$$

$$V_{peak} = V_{rms} \times 1.414 = 120 \times 1.414 = 169.7 \text{ Volts}$$

Now, finding the values of R and C:

$$C(\mu F) = \frac{I^2}{10} = \frac{0.707^2}{10} = 0.05\ \mu F, \text{ voltage rating} \geq 170 \text{ Volts}$$

$$R(\Omega) = \frac{V}{10 \times I^x}, \text{ where } x = 1 + \frac{50}{V}$$

$$x = 1 + \frac{50}{169.7} = 1.29 \qquad R(\Omega) = \frac{169.7}{10 \times 0.707^{1.29}} = 16\ \Omega, 1/2\ W, \pm 5\%$$

If the contact is switching a DC inductive load, add a diode across the load as near to load coil as possible. When the load is energized the diode is reverse-biased (high impedance). When the load is turned off, energy stored in its coil is released in the form of a negative-going voltage spike. At this moment the diode is forward-biased (low impedance) and shunts the energy to ground. This protects the relay contacts from the high voltage arc that would occur just as the contacts are opening.

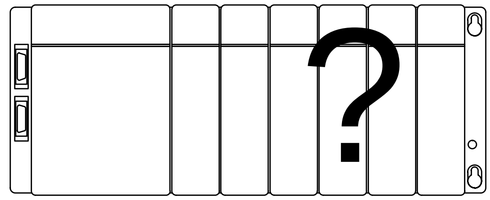
For best results, follow these guidelines in using a noise suppression diode:

- DO NOT use this circuit with an AC power supply.
- Place the diode as close to the inductive field device as possible.
- Use a diode with a peak inverse voltage rating (PIV) at least 100 PIV, 3A forward current or larger. Use a fast-recovery type (such as Schottky type). DO NOT use a small-signal diode such as 1N914, 1N941, etc.
- Be sure the diode is in the circuit correctly before operation. If installed backwards, it short-circuits the supply when the relay energizes.

I/O Module Wiring and Specifications

Module Placement

Before wiring the I/O modules in your system to field devices, it's very important to make sure each I/O module is in the right slot and base in the system. Costly wiring errors may be avoided by doing the following:

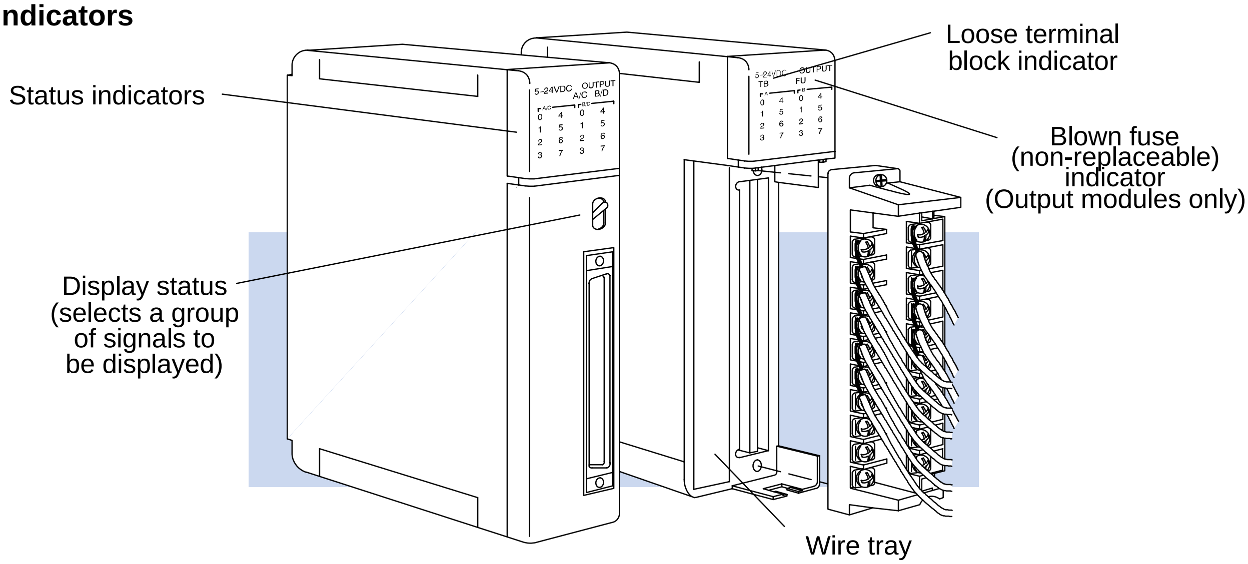


- Perform the power budget calculations for each base to verify the base power supply can power all the modules in the base.
- Whenever possible, keep modules with high voltage and current wiring away from sensitive analog modules.

NOTE: Please refer to the applicable Base Controller User manual for the power budget requirements and worksheets.

I/O Module Status Indicators

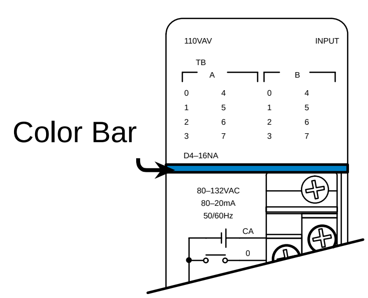
The diagram below shows the status indicator location for common I/O modules.



Color Coding of I/O Modules

The DL405 family of I/O modules have a color-coded stripe on the front bezel to help identify whether the module type is input, output, or special module. The color code description is listed below:

Module Type	Color Code
Discrete/Analog Output	Red
Discrete/Analog Input	Blue
Other	White

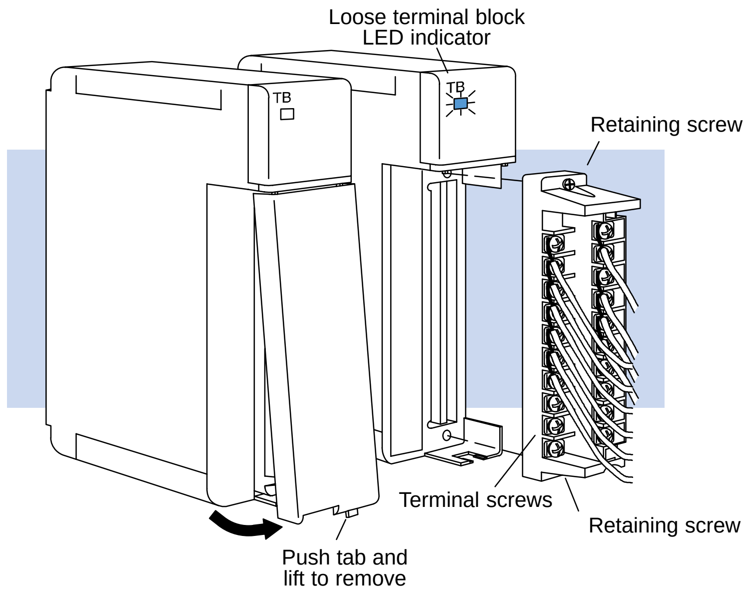


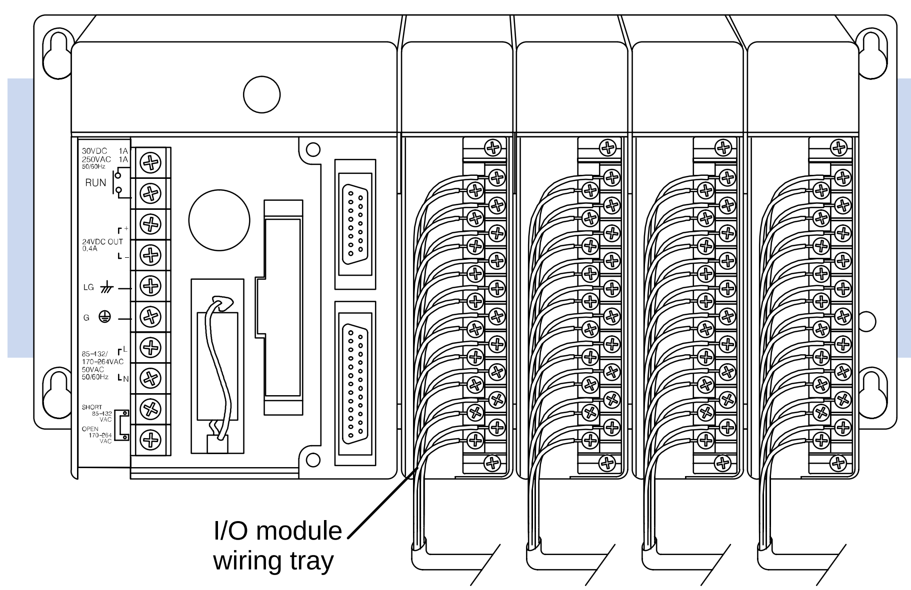
Wiring a Module with a Terminal Block

You must first remove the front cover of the module prior to wiring. To remove the cover depress the bottom tab of the cover and tilt the cover up to loosen from the module.

All DL405 I/O module terminal blocks are removable for your convenience. To remove the terminal block loosen the retaining screws and and lift the terminal block away from the module. When you return the terminal block to the module make sure the terminal block is tightly seated. Be sure to tighten the retaining screws. You should also verify the loose terminal block LED is off when system power is applied.

WARNING: For some modules, field device power may still be present on the terminal block even though the system is turned off. To minimize the risk of electrical shock, disconnect all field device power *before* you remove the connector.



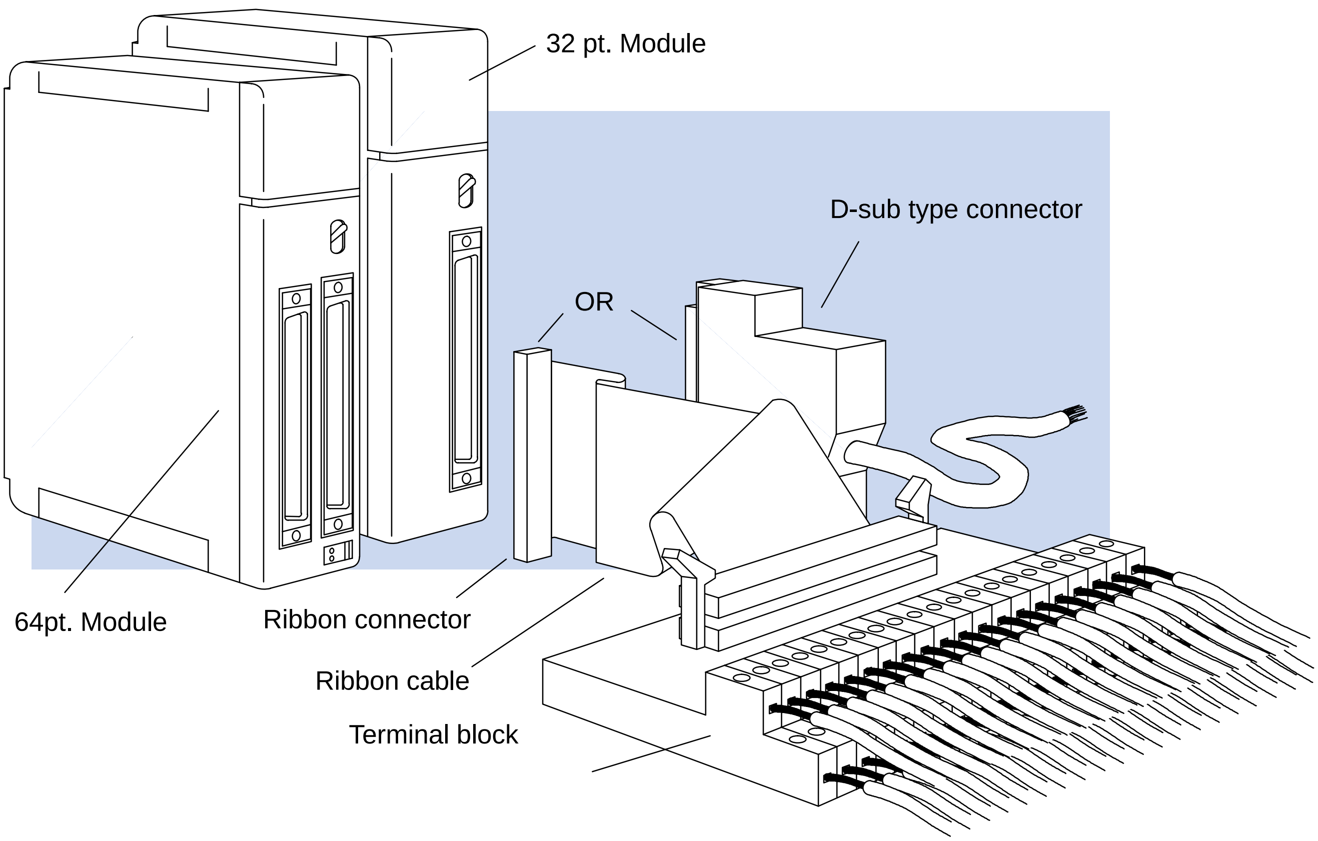


Wiring a Module using a Ribbon Cable/Solder Type Connector

The 32 point and 64 point modules use a different style of connector due to the increased number of I/O points. There are two types of connectors used with the higher density modules. One is a D-shell connector, which requires soldering. The other is a ribbon cable type of connector which simply crimps onto a ribbon cable.

For the 64 point modules, you must either use ribbon cable connectors, or special solder type connectors designed specifically for the 64 point modules. Order part number D4–IO3264S, which includes 2 solder-type connectors in the pack, or order D4–IO32R, which contains 2 ribbon cable type connectors in the pack.

NOTE: For another alternative wiring solution, consider using Automationdirect.com's ***ZIP***Link Connection systems. The ***ZIP***link cables plug directly into a Automationdirect.com I/O module. The opposite end is connected to a ***ZIP***link connector module. Please refer to our catalog for more information on these products.



Part Numbers for Module Connectors

Both types of connectors are available from Automationdirect.com. These same connectors are also available from other Fujitsu Microelectronics, Inc. Use the following part numbers to order these connectors.

Automationdirect.com Part Numbers

- D4–IO3264R — Ribbon cable connectors, 2 in a pack. Can be used on either 32 point or 64 point modules.
- D4–IO3264S — Solder type connector, 2 in a pack. Can be used on either 32 point or 64 point modules.

Fujitsu Part Numbers

For connectors made by Fujitsu, you may contact Fijitsu at the following address:

Fujitsu Microelectronics, Inc.
Electronic Components Division
3545 North First Street
San Jose, CA 95134–1804 USA
408–922–9000

- FCN–367J040–AU/F, or –AG/F — 32 / 64 point ribbon cable connector
- FCN–361J040–AU, or –AG — 32 / 64 point solder type connector

(AU connectors use gold over palladium plating. AG connectors use silver plating.)

Vendors For the Parts Used in the Terminal Block Configuration

If you wish to use a terminal block with your 32 or 64 point module, here is a partial list of vendors who can provide the parts you will need to build the configuration shown earlier consisting of a ribbon cable, a ribbon cable connector and a terminal block.

Vendors	
3M Electronic Products Division 6801 River Place Blvd. Austin, TX 78726–9000 800–225–5373	DuPont Connector Systems Barley Mill Plaza Wilmington, DE 19898–0019 800–237–2374
Augat/RDI 525 Randy Rd. Carol Stream, IL 60188 708–682–4100	Phoenix Contacts Products P.O. Box 4100 Harrisburg, PA 17111–0100 717–944–1300
AMP Incorporated P.O. Box 3608 Harrisburg, PA 17105–3608 717–564–0100	Thomas & Betts Electronics Div. 200 Executive Center Drive Greenville, SC 29616 803–676–2900
Cooper Industries, Belden Div. P.O. Box 1980 Richmond, IN 47375 317–983–5200	Weidmuller, Inc. 821 Southlake Blvd. Richmond, VA 23236 804–794–2877
Newark Electronics 4108 North Ravenswood Ave. Chicago, Il 60640 312–784–5100	(Newark Electronics is a distributor for all of the above product manufac-turers except for Phoenix Contacts Products)

Ribbon Cable

The chart below lists cables which can be used to connect the terminal block with a 32 I/O module. The cables are 40 conductors with a .050” pitch PVC stranded ribbon cable.

Description/Type	Vendor	Part Number
Gray / 26 AWG	3M	3801 / 40
Gray / 26 AWG	Belden	9L260 40
Gray / 28 AWG	Belden	9L280 40
Gray / 28 AWG	DuPont	76825–040
Gray / 28 AWG	AMP	499116–5
Color coded / 26 AWG	3M	3811 / 40
Color coded / 28 AWG	Belden	9R280 40
Color coded / 28 AWG	DuPont	76177–040

Ribbon Cable Connectors

The ribbon cable connectors listed below are for attaching the ribbon cable to the terminal block. The cables are all .100” x .100” 2 x20 female ribbon connectors with a center bump.

Description/Type	Vendor	Part Number
Connector Strain Relief	3M 3M	3417–7640 3448–3040
Connector Strain Relief	3M 3M	3417–7640 3448–3040
Connector (pre-assembled) Strain Relief	3M 3M	89140–0103–T0 3448–89140
Connector (with strain relief)	Thomas & Betts	622–4041
Connector (pre-assembled) Strain Relief	AMP AMP	746286–9 499252–1
Connector (with strain relief)	DuPont	66902–240
Connector (with strain relief)	Molex	15–29–9940

Interface Terminal Block

Below are terminal blocks which can be used to transition a 40 conductor ribbon cable to 40 discrete field wires. The terminal block features are: 2 x 20 .100” x .100” pin center (male) connector head terminals (.2” centers) accepting 22–12 AWG, no fuses.

Description/Type	Vendor	Part Number
Panel Mount Rail Mount	Weidmuller	RI–40A /914897 RI–40A /914908
Rail Mount	Phoenix Contacts	FLKM 40 / 2281076
Special Mount (DIN rail compatible) includes ribbon connector	Augat/RDI	2M40FC

I/O Wiring Checklist

Use the following guidelines when wiring the I/O modules in your system.

Step1 – Note the limits to the size of wire the modules can accept. The table below lists the maximum AWG for each module type. Smaller AWG is acceptable to use for each of the modules.

Module type	Maximum AWG
8 point	12
16 point	14
32 point – common	20
32 point – other	24
64 point	24 (requires ribbon cable)
F4–08THM–X	10 (Thermocouple wire)

Note: 12 AWG Type TFFN or Type MTW can be used on 8pt. modules. 14 AWG Type TFFN or Type MTW can be used on 16pt. modules.

Step2 – Always use a continuous length of wire. Do not splice wires to attain a needed length.

Step3 – Use the shortest possible wire length.

Step4 – Where possible use wire trays for routing .

Step5 – Avoid running wires near high energy wiring.

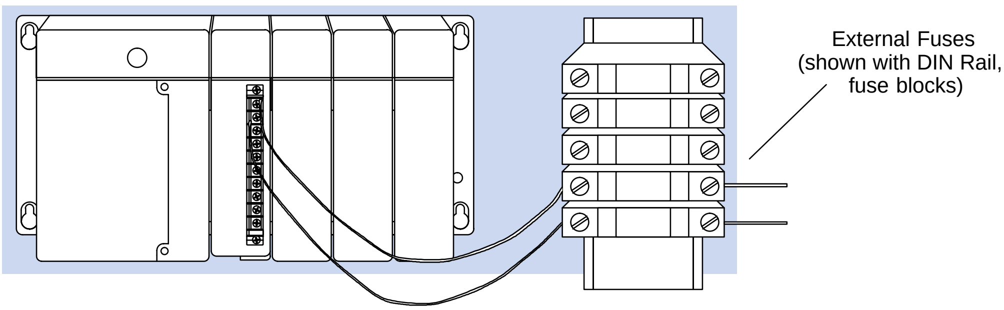
Step6 – Avoid running input wiring close to output wiring where possible.

Step7 – To minimize voltage drops when wires must run a long distance, consider using multiple wires for the return lines.

Step8 – Where possible avoid running DC wiring in close proximity to AC wiring.

Step9 – Avoid creating sharp bends in the wires.

Step10 – **IMPORTANT!** To help avoid having a module with a blown fuse, we suggest you add external fuses to your I/O wiring. A fast blow fuse, with a lower current rating than the I/O module fuse can be added to each common, or a fuse with a rating of slightly less than the maximum current per output point can be added to each output.



NOTE: For modules which have soldered-in or non-replaceable fuses, we recommend that you return your module to us and let us replace your blown fuse(s) since disassembling the module will void the warranty.

DL405 Discrete Input Module Chart

The following table lists the available DL405 input modules.

DL405 Input Module Type	Number of Input Points	DC Current Sink Input	DC Current Source Input	AC Input
D4–16ND2	16		✓	
D4–16ND2F	16		✓	
D4–32ND3–1	32	✓	✓	
D4–32ND3–2	32	✓	✓	
D4–64ND2	64	✓		
D4–08NA	8			✓
D4–16NA (–1)	16			✓
D4–16NE3	16	✓	✓	✓
F4–08NE3S	8	✓	✓	✓
D4–08ND3S	8	✓	✓	

DL405 Discrete Output Module Chart

The following table lists the available DL405 output modules. Specifications begin after the input modules' specifications.

DL405 Output Module Type	Number of Output Points	DC Current Sink Output	DC Current Source Output	AC Output
D4–08TD1	8	✓		
F4–08TD1S	8	✓		
D4–16TD1	16	✓		
D4–16TD2	16		✓	
D4–32TD1	32	✓		
D4–32TD1–1	32	✓		
D4–32TD2	32		✓	
D4–64TD1	64	✓		
D4–08TA	8			✓
D4–16TA	16			✓
D4–08TR	8	✓	✓	✓
F4–08TRS–1	8	✓	✓	✓
F4–08TRS–2	8	✓	✓	✓
D4–16TR	16	✓	✓	✓

Special Input Module Chart

Specification	F4–08THM–n	F4–08RTD
Channels	8	8
Input Ranges	Type E: –270/1000°C (–450/1832°F) Type J: –210/760°C (–350/1390°F) Type K: –270/1370°C (–450/2500°F) Type R: 0/1768°C (–32/3214°F) Type S: 0/1768°C (–32/3214°F) Type T: –270/400°C (–450/752°F) Type C: 0/2320°C (–32/4208°F) Type B: 141/1820°C (286/3594°F) Type P: –99/1395°C (–146/2543°F) –1: 0 to 50mV –2: 0 to 100mV –3: 0 to 25mV	Pt100Ω: –200.0/850.0°C (–328/ 562°F) Pt1000Ω: –200.0/595.0°C (–328/1103°F) jPt100Ω: –38.0/450.0°C (–36/842°F) Cu. 25Ω, Cu. 10Ω: –200.0/260.0°C (–328/500°F)
Resolution	12 bit (1 in 4096)	15 bit (1 in 32768)
Maximum Inaccuracy	±1° C type J,K,E,T thermocouples ±3° C type R,S,B,C,P thermocouples	±0.2% at 25°C (77°F)

Special Input Module Chart

Specification	F4–08THM
Channels	8
Input Ranges	Type J: –190/760°C (–310/1400°F) Type E: –210/1000°C (–346/1832°F) Type K: –150/1372°C (–238/2502°F) Type R: 65/1768°C (149/3214°F) Type S: 65/1768°C (149/3214°F) Type T: –230/400°C (–382/752°F) Type B: 529/1820°C (984/3308°F) Type N: –70/1300°C (–94/2372°F) Type C: 65/2320°C (149/4208°F) –1: 0 to 50mV –2: 0 to 100mV –3: 0 to 25mV
Resolution	16 bit (1 in 65535)
Maximum Inaccuracy	±3° C (excluding thermocouple error)

Analog Input Module Chart

Specification	F4–04AD	F4–04ADS	F4–08AD
Channels	4	4	8
Input Ranges	0–20 mA, 4–20 mA, 1–5V, 0–5V, 0–10V, ±5V, ±10V	0–20 mA, 4–20 mA, 1–5V, 0–5V, 0–10V, ±5V, ±10V	0–20 mA, 4–20 mA, 1–5V, 0–5V, 0–10V, ±5V, ±10V
Resolution	12 bit (1 in 4096)	12 bit (1 in 4096)	12 bit (1 in 4096)
Input Type	Single ended	Isolated	Single ended
Maximum Inaccuracy	±0.4% at 25°C (77°F) ±0.55% at 0° to 60° C (32° to 140°F)	±0.4% at 25°C (77°F) ±0.7% at 0° to 60°C (32° to 140°F)	±0.3% at 25°C (77°F) ±0.5% at 0° to 60°C (32° to 140°F)

Analog Output Module Chart

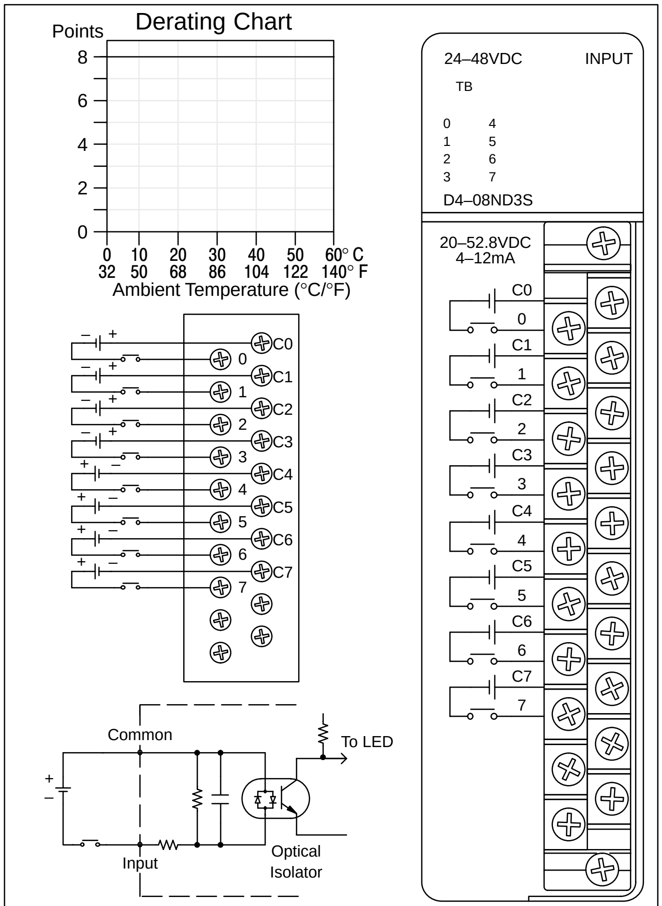
Specification	D4–02DA	F4–04DA	F4–04DA–1
Channels	2	4	4
Output Ranges	4–20 mA, 1–5V, 0–10V	4–20 mA, 0–5V, 0–10V, ±5V, ±10V	4–20mA
Resolution	12 bit (1 in 4096)	12 bit (1 in 4096)	12 bit (1 in 4096)
Output Type	Independent	Single ended	Single ended
Maximum Inaccuracy	±0.2% at 25°C (77°F)	±0.5% at 60°C (unipo.) ±0.7% at 60°C (bipol.) ±0.8% at 60°C (curr.)	±0.1 % at 25°C (77°F) ±0.3 % at 0 to 60°C (32 to 140°F)
Specification	**F4–04DA–2**	**F4–08DA–1**	**F4-16DA-1**
Channels	4	8	16
Output Ranges	0–5V, 0–10V, ±5V, ±10V	4–20mA	4–20 mA
Resolution	12 bit (1 in 4096)	12 bit (1 in 4096)	12 bit (1 in 4096)
Output Type	Single ended	Single ended	Single ended
Maximum Inaccuracy	±0.2 % at 25°C (77°F) ± 0.4% at 0° to 60°C (32° to 140°F)	±0.2% at 25°C (77°F) ±0.4% at 0° to 60°C (32° to 140°F)	±0.2 % at 25°C (77°F) ±0.4 % at 0° to 60°C (32° to 140°F)
Specification	**F4–04DAS–1**	**F4–08DA–2**	**F4-16DA-2**
Channels	4	8	16
Output Ranges	4–20 mA	0–5v, 0–10v	0–5v, 0–10v, Combination of both
Resolution	16 bit (1 in 65536)	12 bit (1 in 4096)	12 bit (1 in 4096)
Output Type	Single ended	Single ended	Single ended
Maximum Inaccuracy	±0.07 % at 25°C(77°F) ± 0.18% at 0° to 60°C (32° to 140°F)	±0.2% at 25°C (77°F) ±0.4% at 0° to 60°C (32° to 140°F)	±0.2 % at 25°C (77°F) ±0.4 % at 0° to 60°C (32° to 140°F)

Glossary of Specification Terms

Inputs or Outputs Per Module	Indicates number of electrical input or output points per module and designates current sinking, current sourcing, or either.
Commons Per Module	Number of electrical commons per module. A common is a connection to an input or output module which is shared by multiple I/O circuits. It is ususally in the return path to the power supply of the I/O circuit.
Input Voltage Range	The operating voltage range of an input circuit, measured from an input point to its common terminal, when the input is ON.
Output Voltage Range	The output voltage range of an output circuit, measured from an output point to its common terminal, when the output is OFF.
Peak Voltage	Maximum voltage allowed for an input or output circuit for a short duration.
AC Frequency	AC modules are designed to operate within a specific frequency range.
ON Voltage Level	The minimum voltage level at which an input point will turn ON.
OFF Voltage Level	The maximum voltage level at which an input point will turn OFF.
Input Impedance	The electrical resistance measured between an input point and its common point. Since this resistance is non-linear, it may be listed for various input currents.
Input Current	Typical operating current for an active (ON) input.
Minimum ON Current	The minimum current for the input circuit to operate reliably in the ON state.
Maximum OFF Current	The maximum current for the input circuit to operate reliably in the OFF state.
Minimum Load	The minimum load current required for an output circuit to operate properly.
External DC Required	Some output modules require external power for the output circuitry.
On Voltage Drop	Sometimes called “saturation voltage”, it is the voltage measured from an output point to its common terminal when the output is ON, at max. load.
Maximum Leakage Current	The maximum current a connected maximum load will receive when the output point is OFF.
Maximum Inrush Current	The maximum current used by a load for a short duration upon an OFF to ON transition of a output point. It is greater than the normal ON state current and is characteristic of inductive loads in AC circuits.
Base Power Required	The +5VDC power from the base required to operate the module. Be sure to observe the base power budget calculations.
OFF to ON Response	The time the module requires to process an OFF to ON state transition.
ON to OFF Response	The time the module requires to process an ON to OFF state transition.
Status Indicators	The LEDs that indicate the ON/OFF status of an input or output point. These LEDs are electrically located on the logic (CPU) side of the I/O interface circuit.
Terminal Type	Indicates whether the module’s connector is removable or non-removable.
Weight	Indicates the weight of the module.
Fuses	Protective device for an output circuit, which stops current flow when current exceeds the fuse rating current. It may be replaceable or non-replaceable, or located externally or internally.

D4–08ND3S DC Input

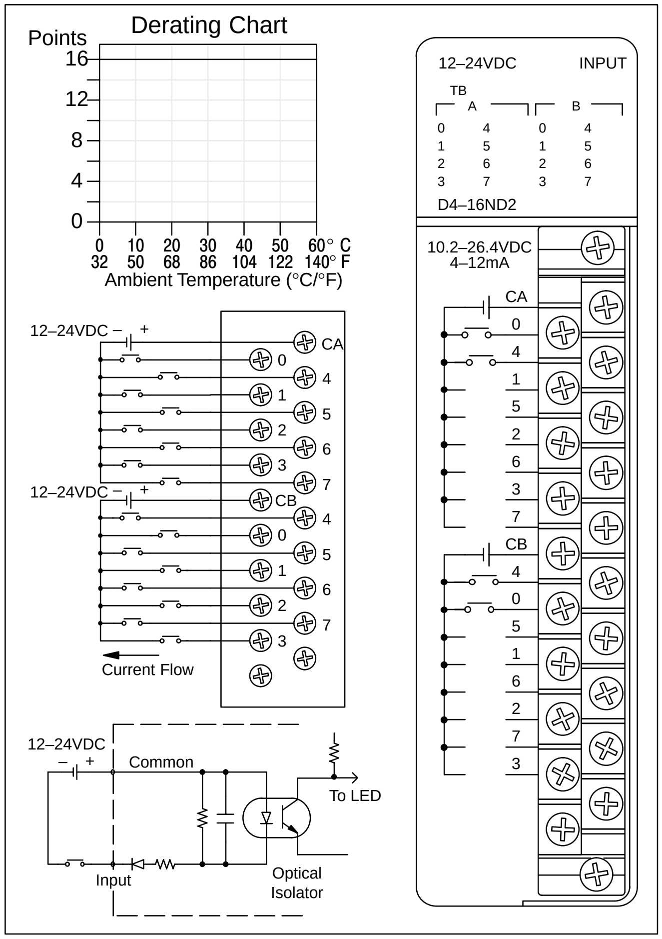
Inputs per module	8 (sink/source)
Commons per module	8 (isolated)
Input voltage range	20–52.8VDC
Peak voltage	52.8VDC
ON voltage level	>18 V
OFF voltage level	< 7V
Input impedance	4.8 K Ω
Input current @ 24 / 48 VDC	5 mA / 10 mA
Minimum ON current	3.5 mA
Maximum OFF current	1.5 mA
Base power required 5V	100 mA max
OFF to ON response	3–10 ms
ON to OFF response	3–12 ms
Terminal type	Removable
Status indicators	Logic Side
Weight	8.8 oz. (250 g)



Current sourcing configuration shown

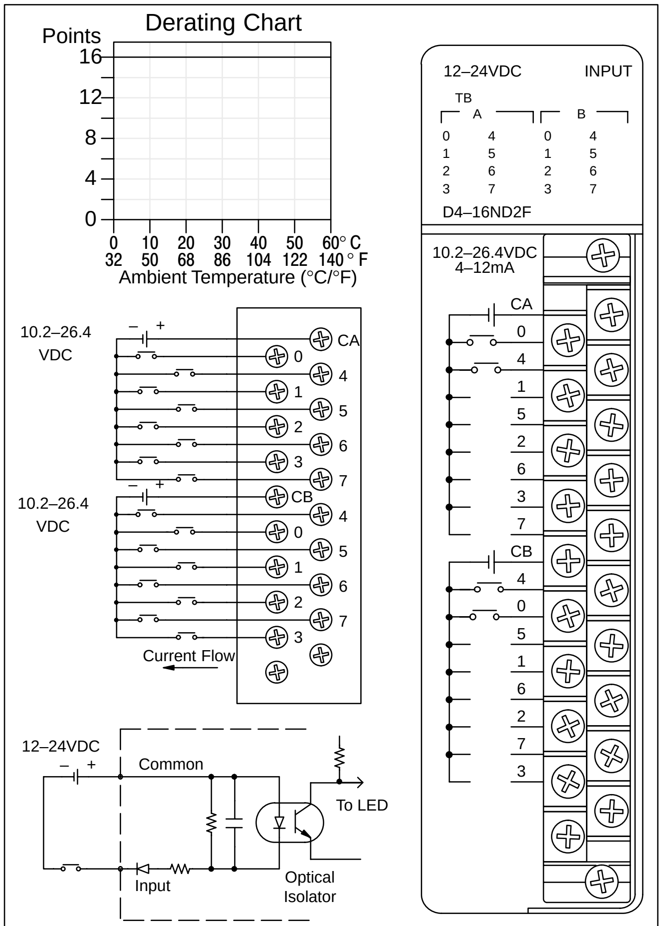
D4–16ND2 DC Input

Inputs per module	16 (current sourcing)
Commons per module	2 (isolated)
Input voltage range	10.2–26.4VDC
Peak voltage	26.4VDC
ON voltage level	> 9.5VDC
OFF voltage level	< 4.0 VDC
Input impedance	3.2 KΩ @ 12VDC 2.9 KΩ @24VDC
Input current @ 12 / 24VDC	3.8 mA / 8.3 mA
Minimum ON current	3.5 mA
Maximum OFF current	1.5 mA
Base power required 5V	150 mA max
OFF to ON response	1–7 ms (2.3 typical)
ON to OFF response	2–12 ms (4.6 typical)
Terminal type	Removable
Status indicators	Logic Side
Weight	8.8 oz. (250 g)



D4–16ND2F DC Input

Inputs per module	16 (current sourcing)
Commons per module	2 (isolated)
Input voltage range	10.2–26.4VDC
Peak voltage	26.4VDC
ON voltage level	> 9.5VDC
OFF voltage level	< 4.0VDC
Input impedance	3.2 K Ω @ 12VDC 2.9 K Ω @ 24VDC
Input current @ 12 / 24 VDC	3.8 mA / 8.3 mA
Minimum ON current	3.5 mA
Maximum OFF current	1.5 mA
Base power required 5V	150 mA max
OFF to ON response	1 ms
ON to OFF response	1 ms
Terminal type	Removable
Status indicators	Logic Side
Weight	8.8 oz. (250 g)

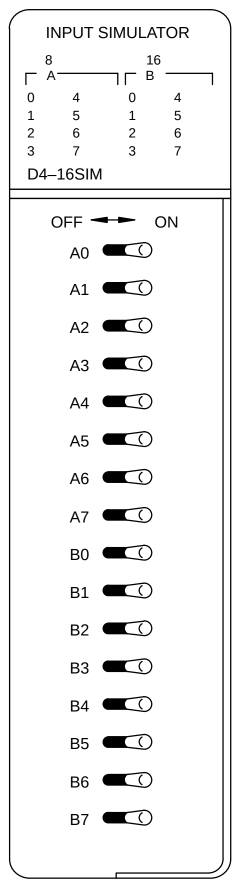


D4–16SIM Input Simulator

Inputs per module	8 or 16, selectable
Base power required 5V	150 mA Max
Terminal type	None
Status indicators	Logic Side
Weight	8.8 oz. (250 g)

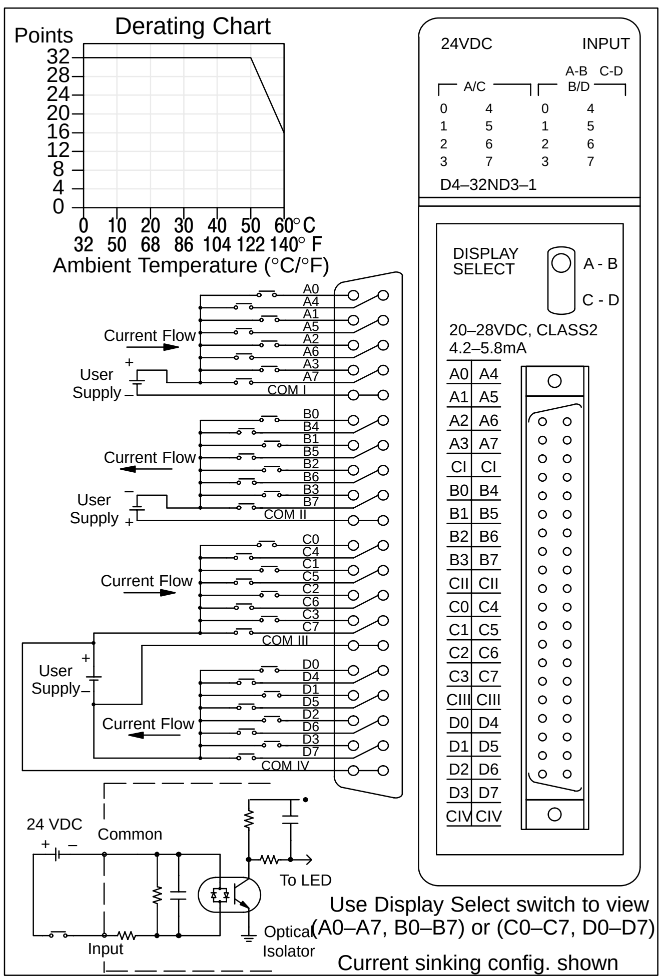
8 or 16 input point selection switch is located on the back of the module

Switch position is indicated by the LEDs above the input switches



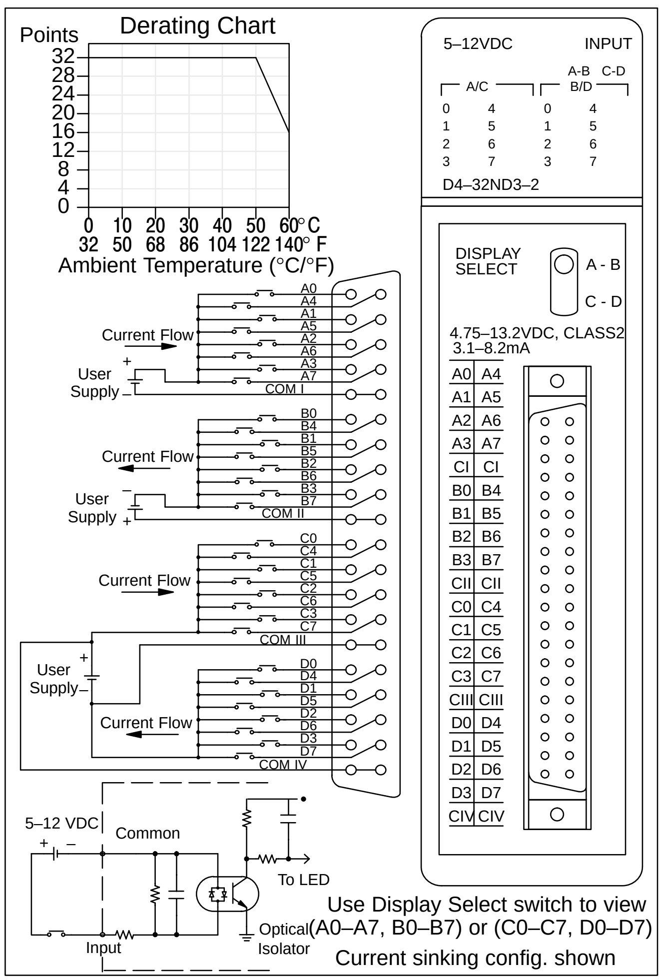
D4–32ND3–1, 24VDC Input

Inputs per module	32 (sink/source)
Commons per module	4 (isolated)
Input voltage range	20–28VDC
Peak voltage	30VDC
ON voltage level	> 19V
OFF voltage level	< 10 V
Input impedance	4.8 K Ω
Input current	5 mA
Minimum ON current	3.5 mA
Maximum OFF current	1.6 mA
Base power required 5V	150 mA max
OFF to ON response	2–10 ms
ON to OFF response	2–10 ms
Terminal type	Removable, 40 pin conn.
Status indicators	Logic Side
Weight	6.6 oz. (190 g)



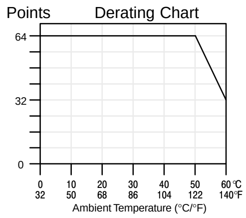
D4–32ND3–2 5–12VDC Input

Inputs per module	32 (sink/source)
Commons per module	4 (isolated)
Input voltage range	4.75–13.2VDC (TTL, CMOS)
Peak voltage	15VDC
ON voltage level	> 4 V (use pullup R for TTL in)
OFF voltage level	< 2 V
Input impedance	1.6 KΩ
Input current	3.1 mA @ 5V, 7.5 mA @ 12V
Minimum ON current	1.8 mA
Maximum OFF current	0.8 mA
Base power required 5V	150 mA max
OFF to ON response	1–4 ms
ON to OFF response	1–4 ms
Terminal type	Removable, 40 pin conn.
Status indicators	Logic Side
Weight	6.6 oz. (190 g)

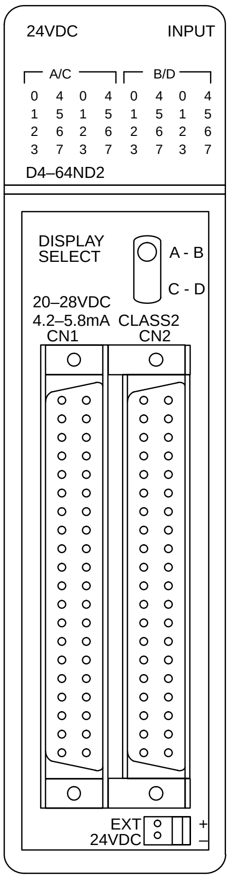


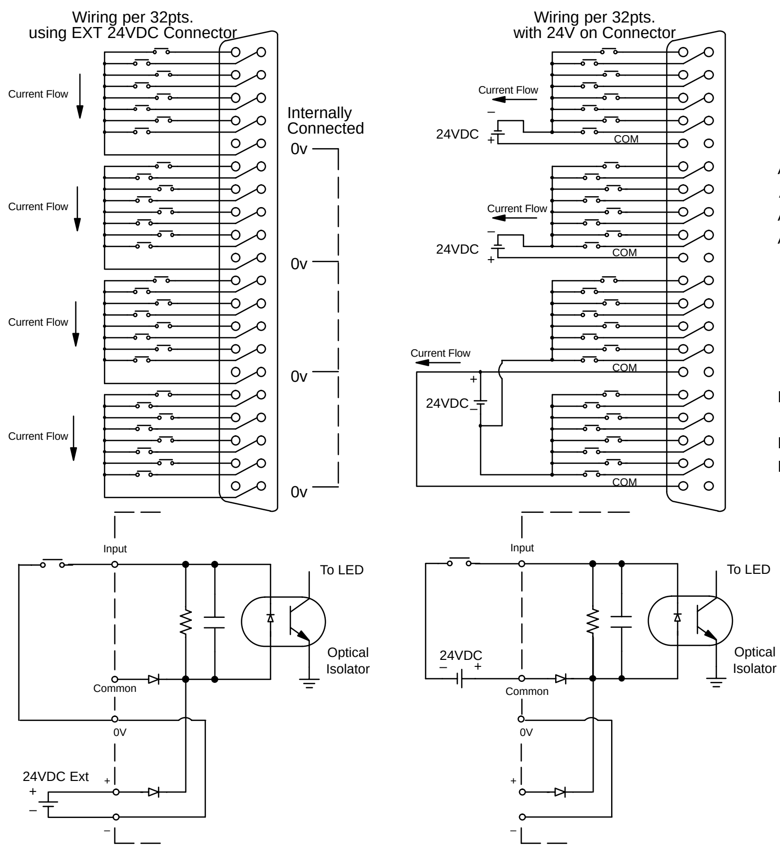
D4–64ND2, 24 VDC Input Module

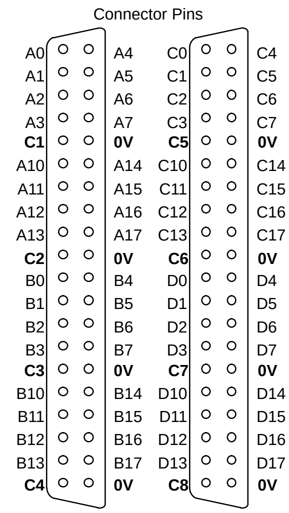
Module Location	CPU base only *	Base power required 5V	300 mA max
Inputs per module	64 (current sourcing)	External power required (optional)	24VDC ±10%, 320mA max
Commons per module	8 (isolated)	OFF to ON response	2.5 ms (typical)
Input voltage range	20 – 28 VDC	ON to OFF response	5.0 ms (typical)
Peak voltage	30 VDC	Terminal type	2, Removable 40 pin connectors (sold separately)
ON voltage level	> 20 V		
OFF voltage level	< 13 V	Status indicators	Logic Side
Input impedance	4.8 K Ω	Weight	7.8 oz. (220 g)
Input current	5.0 mA @ 24 VDC		
Minimum ON current	3.6 mA		
Maximum OFF current	2.6 mA		



Since there are only 32 LEDs on the module, you can only display the status for 32 points at one time. In the A - B position the status of the first group of 32 input points (A0–A17, B0–B17) are displayed (connector 1). In the C - D position the status of the second group of 32 input points (C0–C17, D0–D17) are displayed (connector 2).



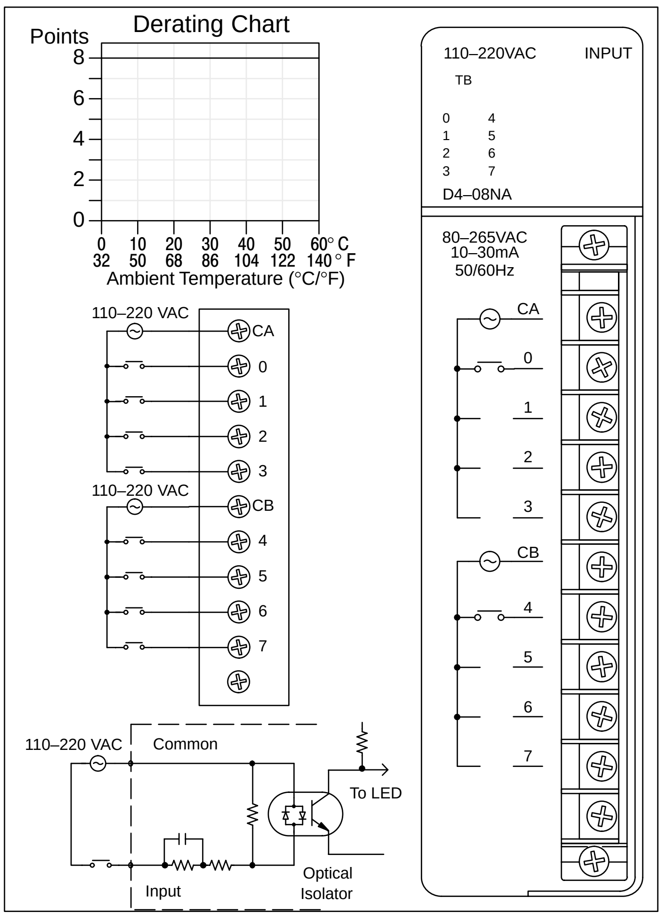




* Module location – this module placement is restricted to the local base on DL430/DL440 systems. It may also be placed in expansion bases in DL450 systems that are using the new (–1) bases.

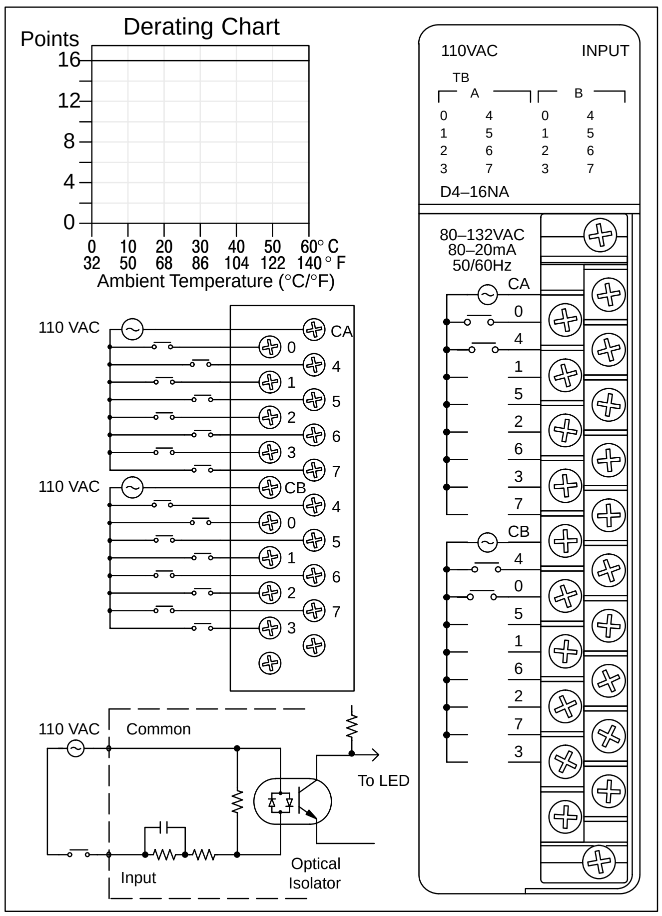
D4–08NA 110–220VAC Input

Inputs per module	8
Commons per module	2 (isolated)
Input voltage range	80–265VAC
Peak voltage	265VAC
AC frequency	47–63 Hz
ON voltage level	> 70V
OFF voltage level	< 30 V
Input impedance	12 K Ω
Input current	8.5 mA @100VAC 20 mA @ 230VAC
Minimum ON current	5 mA
Maximum OFF current	2 mA
Base power required 5V	100 mA max
OFF to ON response	5–30 ms
ON to OFF response	10–50 ms
Terminal type	Removable
Status indicators	Logic Side
Weight	8.4 oz. (240 g)



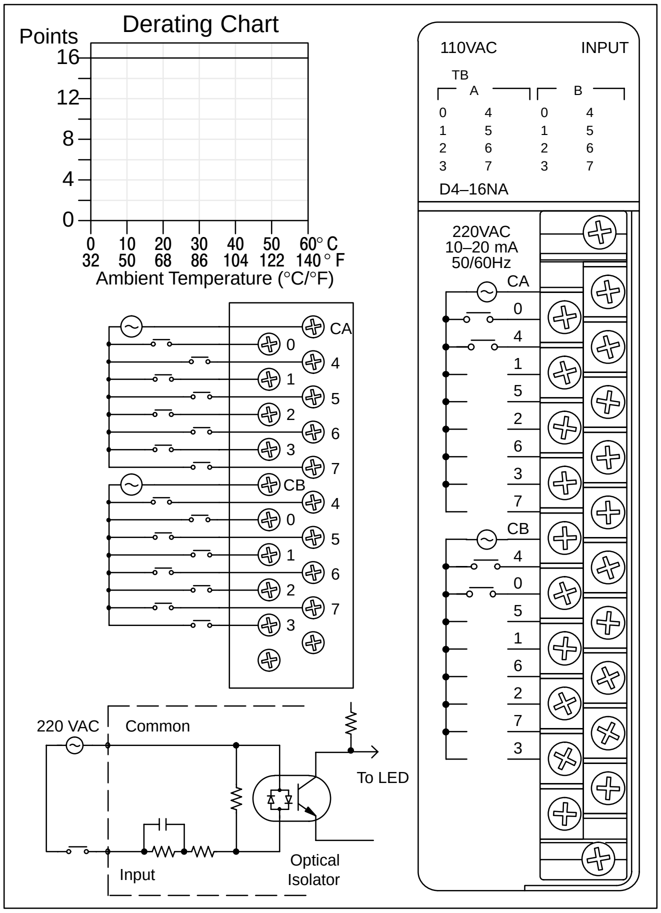
D4–16NA 110VAC Input

Inputs per module	16
Commons per module	2 (isolated)
Input voltage range	80–132VAC
Peak voltage	132VAC
AC frequency	47–63 Hz
ON voltage level	> 70V
OFF voltage level	< 20 V
Input impedance	8 K Ω
Input current	14.5 mA @120VAC
Minimum ON current	7 mA
Maximum OFF current	2 mA
Base power required 5V	150 mA max
OFF to ON response	5–30 ms
ON to OFF response	10–50 ms
Terminal type	Removable
Status indicators	Logic Side
Weight	9.5 oz. (270 g)



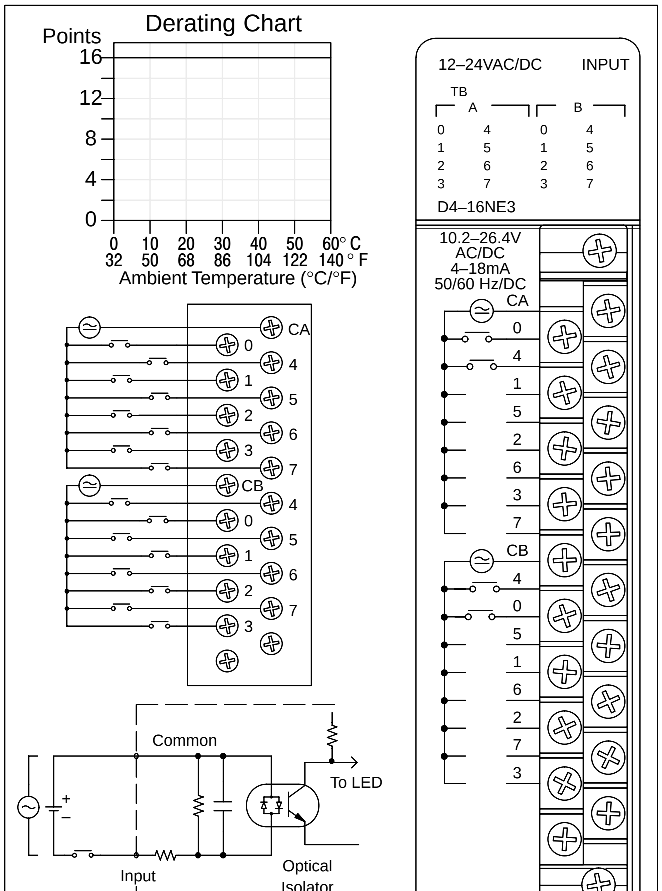
D4–16NA–1 220VAC Input

Inputs per module	16
Commons per module	2 (isolated)
Input voltage range	187–238VAC
Peak voltage	265VAC
AC frequency	47–63 Hz
ON voltage level	> 150V
OFF voltage level	< 40 V
Input impedance	22 K Ω
Input current	10.0 mA @220VAC
Minimum ON current	7 mA
Maximum OFF current	2 mA
Base power required 5V	150 mA max
OFF to ON response	5–30 ms
ON to OFF response	10–50 ms
Terminal type	Removable
Status indicators	Logic Side
Weight	9.5 oz. (270 g)



D4-16NE3 12–24VAC/DC Input

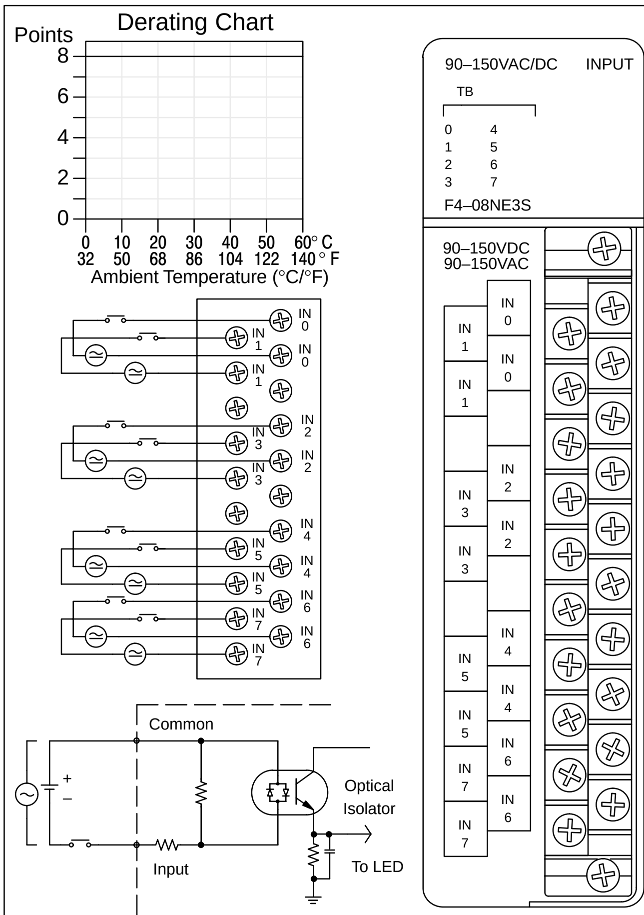
Inputs per module	16 (sink/source)
Commons per module	2 (isolated)
Input voltage range	10.2–26.4VAC/VDC
Peak voltage	37.5VAC/VDC
AC frequency	47–63 Hz
ON voltage level	> 9.5V
OFF voltage level	< 3.0V
Input impedance @ 12V/24V	3.2 K Ω / 2.9 K Ω
Input current @ 12V / 24V	3.8 mA / 8.3 mA
Minimum ON current	4 mA
Maximum OFF current	1.5 mA
Base power required 5V	150 mA max
OFF to ON response	5–40 ms
ON to OFF response	10–50 ms
Terminal type	Removable
Status indicators	Logic Side
Weight	8.8 oz. (250 g)



Current sourcing configuration shown

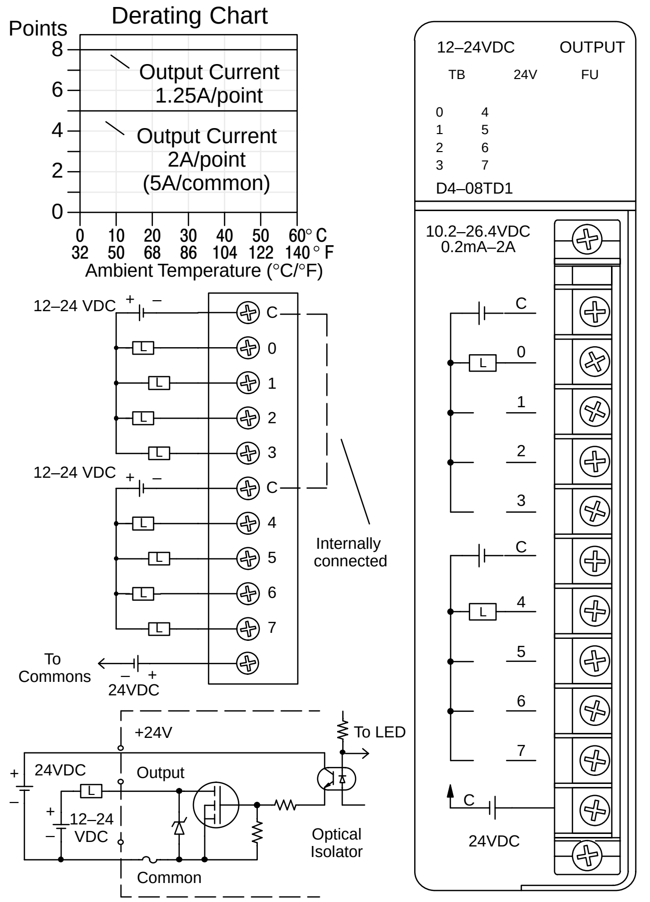
F4-08NE3S 90–150VAC/DC In

Inputs per module	8 (sink/source)
Commons per module	8 (isolated)
Input voltage range	90–150 VAC/VDC
Peak voltage	350 peak < 1ms
AC frequency	47–63 Hz
ON voltage level	> 90 VDC / 75VAC
OFF voltage level	< 60 VDC / 45VAC
Input impedance	22 K Ω
Input current	5.5 mA @ 120V
Minimum ON current	4 mA
Maximum OFF current	2 mA
Base power required 5V	90 mA max
OFF to ON response	8 ms
ON to OFF response	15 ms
Terminal type	Removable
Status indicators	Logic Side
Weight	9 oz. (256 g)



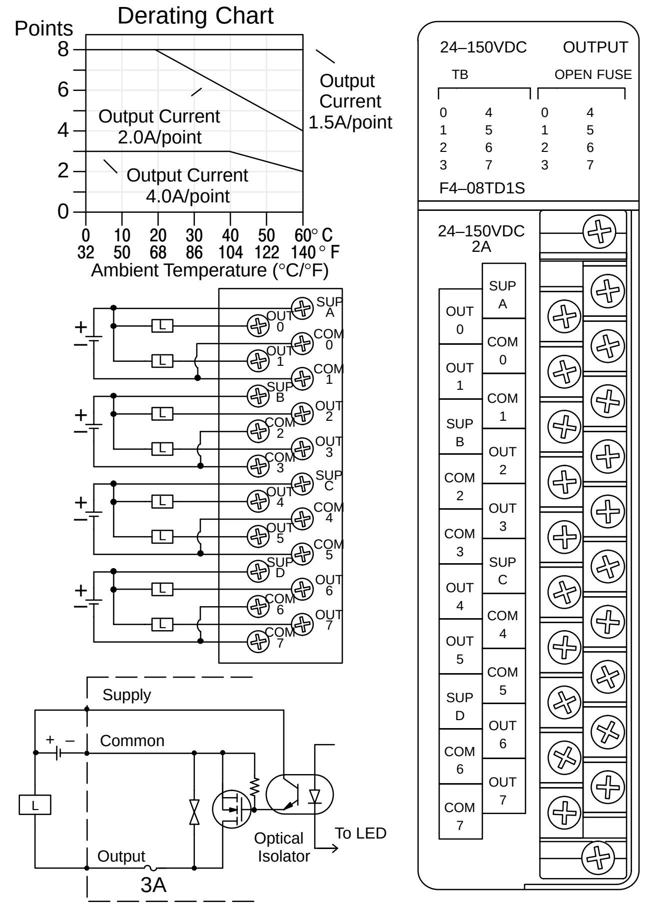
D4–08TD1 12–24 VDC Output

Outputs per module	8 (current sinking)
Commons per module	2 internally connected
Operating voltage	10.2–26.4VDC
Output type	NMOS FET (open drain)
Peak voltage	40VDC
ON voltage drop	0.5VDC @ 2A, 0.2 VDC @1A
Max current (resistive)	2A / point, 5A / common
Max leakage current	0.1mA @ 40VDC
Max inrush current	12A for 10 ms, 6A for 100 ms
Minimum load	0.2mA
Base power required 5V	150mA max
External DC required	24VDC ±10%@35 mA
OFF to ON response	1 ms
ON to OFF response	1 ms
Terminal type	Removable
Status indicators	Logic Side
Weight	8.4 oz. (240 g)
Fuses (non-replaceable)	1 (7A) per common



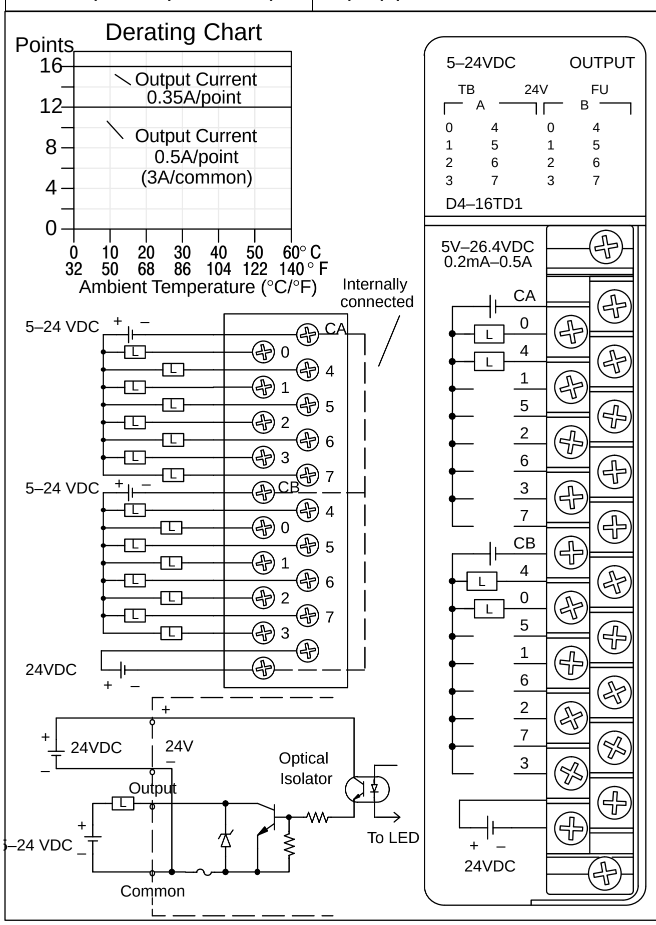
F4-08TD1S 24–150 VDC Isolated Out

Outputs per module	8 (current sinking)
Commons per module	4 (isolated)
Operating voltage	24–150VDC
Output type	MOS FET
Peak voltage	200 VDC, <1mS
ON voltage drop	1VDC @ 2A
Max current	2A / point, 4A / common
Max leakage current	5 µA
Max inrush current	30A /1ms, 6A / 10ms, 3A / 100ms
Minimum load	N/A
Base power required 5V	295 mA max
External DC required	None
OFF to ON response	25 µs
ON to OFF response	25 µs
Terminal type	Removable
Status indicators	Logic Side
Weight	10 oz. (282 g)
Fuses (non-replaceable)	1 (3A) per output



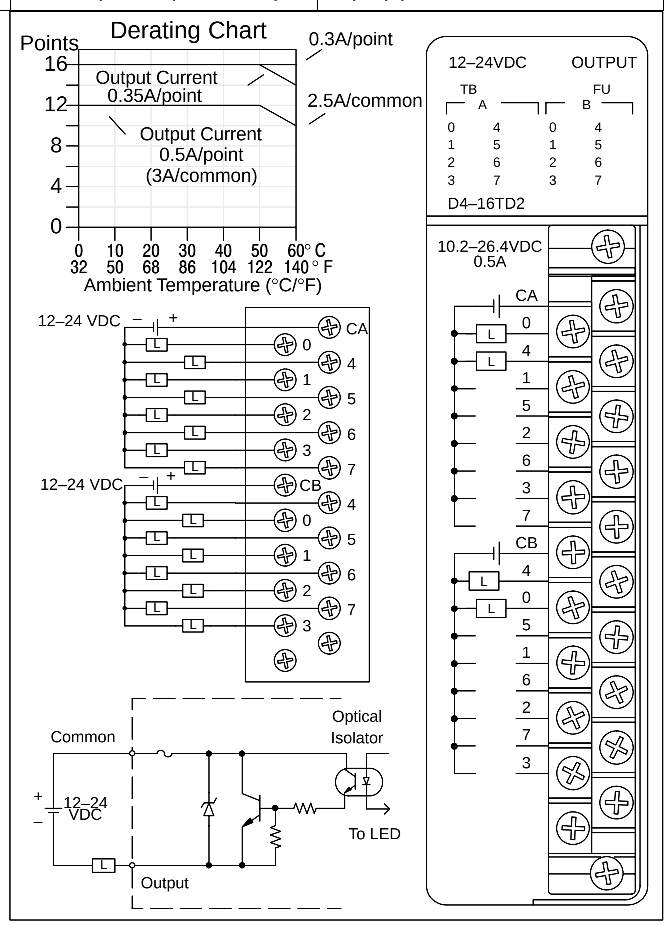
D4-16TD1 5-24 VDC Output

Outputs per module	16 (current sinking)
Commons per module	2 internally connected
Operating voltage / peak	4.5–26.4VDC, 40 VDC Peak
Output type	NPN Open collector
ON voltage drop	0.5V @ 0.5A, 0.2V @ 0.1A
Max current (resistive)	0.5A / point, 3A / common
Max leakage current	0.1mA @ 40VDC
Max inrush current	2A for 10 ms, 1A for 100 ms
Minimum load	0.2mA
Base power required 5V	200mA max
External DC required	24VDC ±10% @125mA
OFF to ON response	0.5 ms
ON to OFF response	0.5 ms
Terminal type	Removable
Status indicators	Logic Side
Weight	9.5 oz. (270 g)
Fuses (non-replaceable)	1 (5A) per common



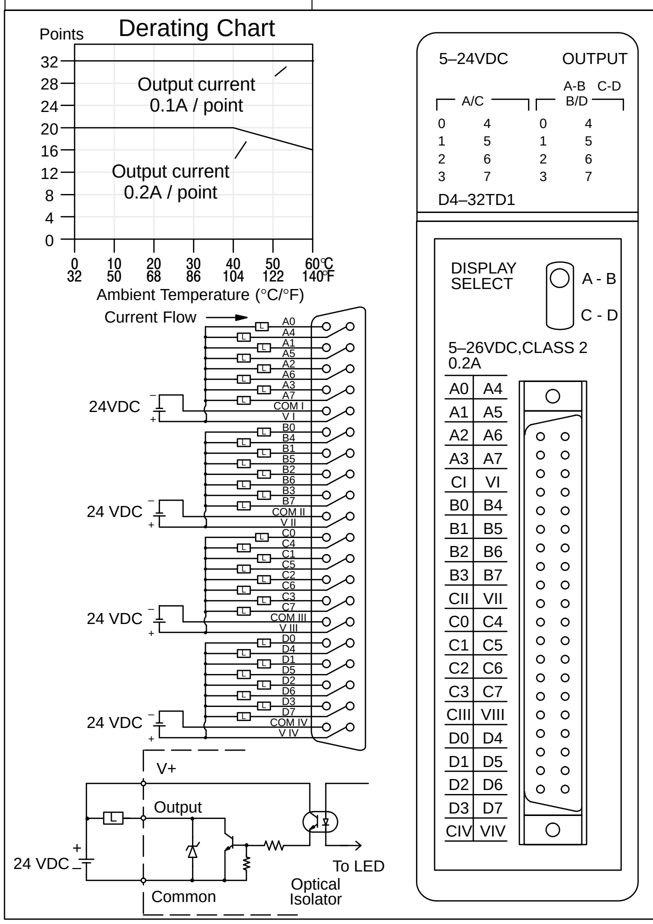
D4-16TD2, 12–24 VDC Output

Outputs per module	16 (current sourcing)
Commons per module	2 (isolated)
Operating voltage / peak	10.2–26.4 VDC, 40 VDC Peak
Output type	NPN Emitter Follower
ON voltage drop	1.5 VDC @ 0.5A
Max current (resistive)	0.5A / point, 3A / common @ 50° C, 2.5A /common @ 60°C
Max leakage current	0.1mA @ 40 VDC
Max inrush current	2A for 10 ms, 1A for 100 ms
Minimum load	0.2mA
Base power required 5V	400mA max
External DC required	None
OFF to ON response	1 ms
ON to OFF response	1 ms
Terminal type	Removable
Status indicators	Logic Side
Weight	9.8 oz. (280 g)
Fuses (non-replaceable)	1 (5A) per common



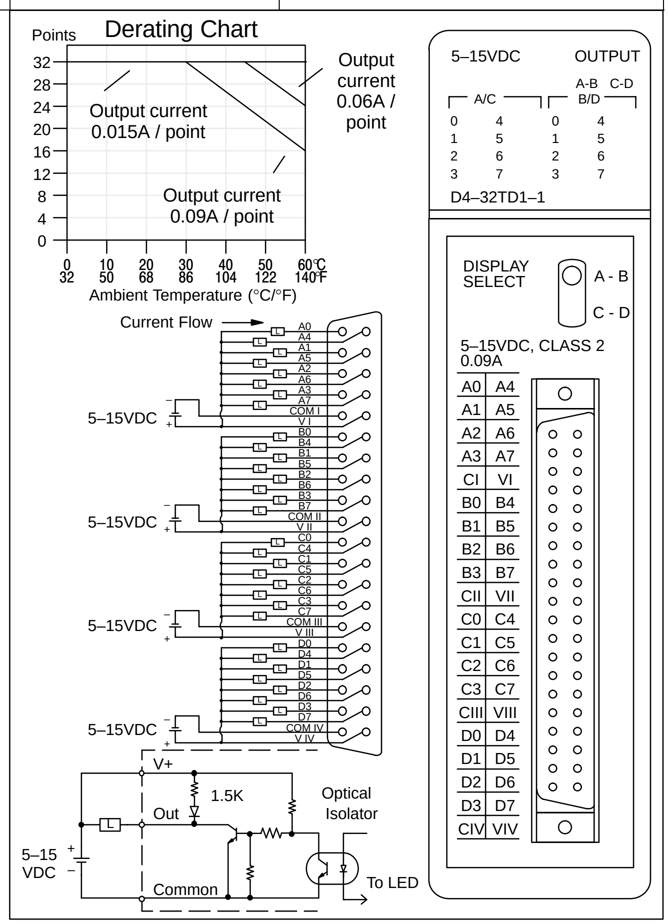
D4–32TD1, 5–24VDC Output

Outputs per module	32 (current sinking)
Commons per module	4 (isolated)
Operating voltage	4.75–26.4 VDC
Output type	NPN Open Collector
Peak voltage	36 VDC
ON voltage drop	0.6 VDC @ 0.2A
Max current (resistive)	0.2A / point, 1.6A / common
Max leakage current	0.1mA @ 36 VDC
Max inrush current	1A for 10 ms, 0.5A for 100 ms
Minimum load	0.1mA
Base power required 5V	250mA max
External DC required	24VDC ±10%, 140mA max
OFF to ON response	0.1 ms
ON to OFF response	0.1 ms
Terminal type	Removable
Status indicators	Logic Side
Weight	6.7 oz. (190 g)
Fuses	None



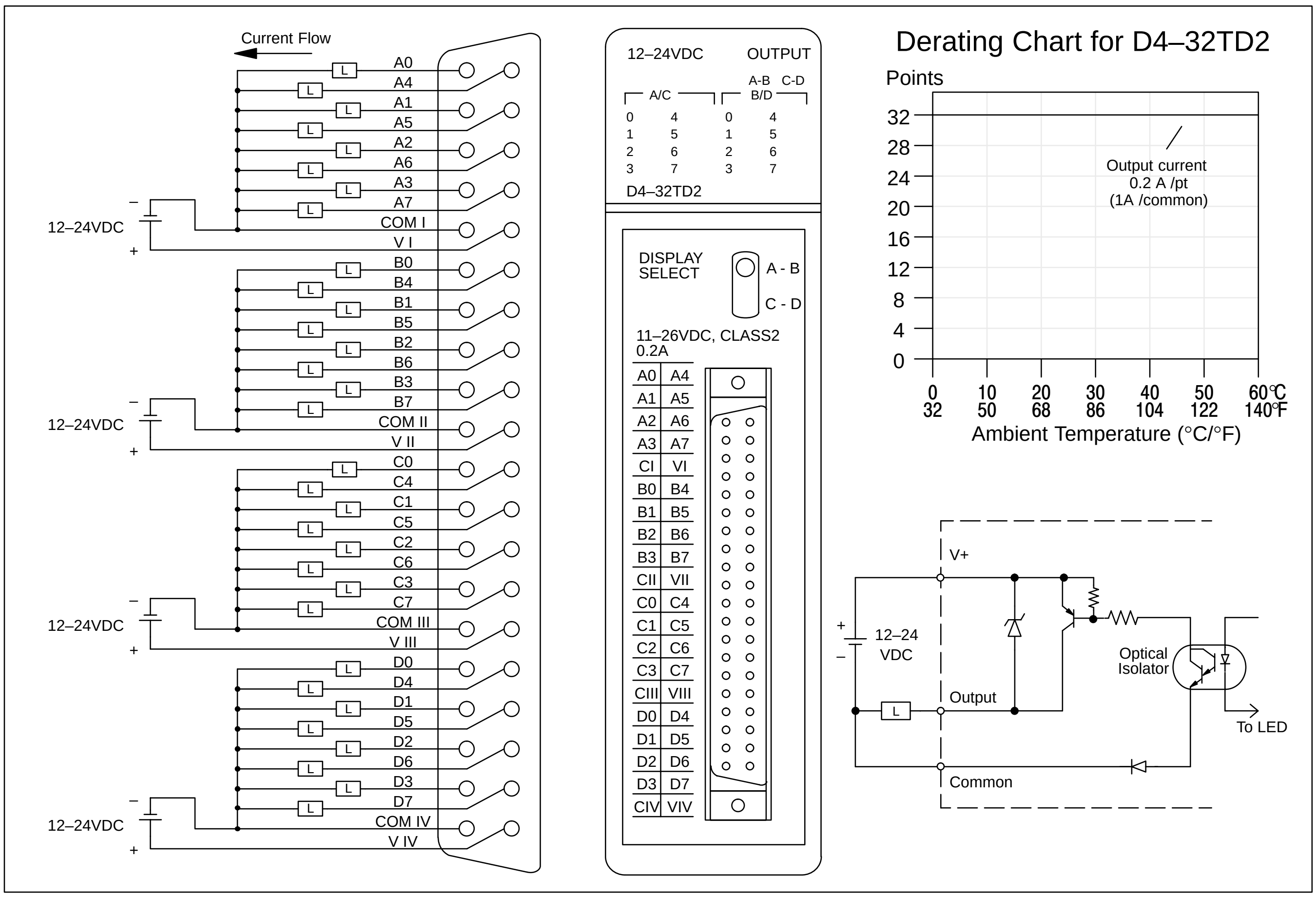
D4–32TD1–1, 5–15VDC Output

Outputs per module	32 (current sinking)
Commons per module	4 (isolated)
Operating voltage	5–15 VDC
Output type	NPN Open Collector (w / pullup)
Peak voltage	16.5 VDC
ON voltage drop	0.4 VDC @ 0.1A
Max current (resistive)	0.09A/pt, 0.72A/com, 2.88A/ mod.
Max leakage current	0.01mA @ 16.5 VDC
Max inrush current	0.5A for 10ms, 0.2A for 100ms
Minimum load	0.1mA
Base power req., 5V	250mA max
External DC required	5–15VDC ±10%, 700mA max
OFF to ON response	0.1 ms
ON to OFF response	0.1 ms
Terminal type	Removable
Status indicators	Logic Side
Weight	6.7 oz. (190 g)
Fuses	None



D4–32TD2, 12–24 VDC Output Module

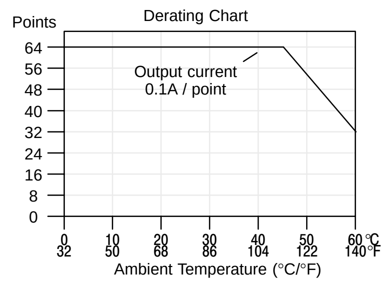
Outputs per module	32 (current sourcing)	External DC required	10.8–26.4VDC 1A / common including load
Commons per module	4 (isolated)		
Operating voltage	10.8–26.4 VDC		
Output type	PNP Open Collector	OFF to ON response	< 0.2 ms
Peak voltage	30 VDC	ON to OFF response	< 0.2 ms
ON voltage drop	0.6 VDC @ 0.2A	Terminal type	Removable
Max current (resistive)	0.2A / point 1.0A / common 4.0A / module	Status indicators	Logic Side
		Weight	6.7 oz. (190 g)
Max leakage current	0.01mA @ 26.4 VDC	Fuses	None
Max inrush current	500 mA for 10 ms		
Minimum load	0.2mA		
Base power required 5V	350mA max		



Only 16 status points can be displayed at one time on the front of the module.
In the A - B position the status of the first group of 16 output points (A0–A7, B0–B7) is displayed.
In the C - D position the status of the second group of 16 output points (C0–C7, D0–D7) is displayed.

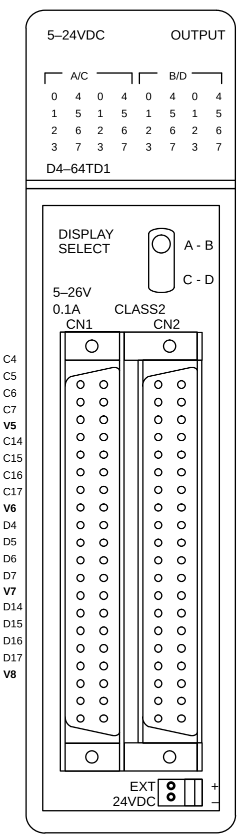
D4–64TD1, TTL/CMOS/5–24 VDC Output Module

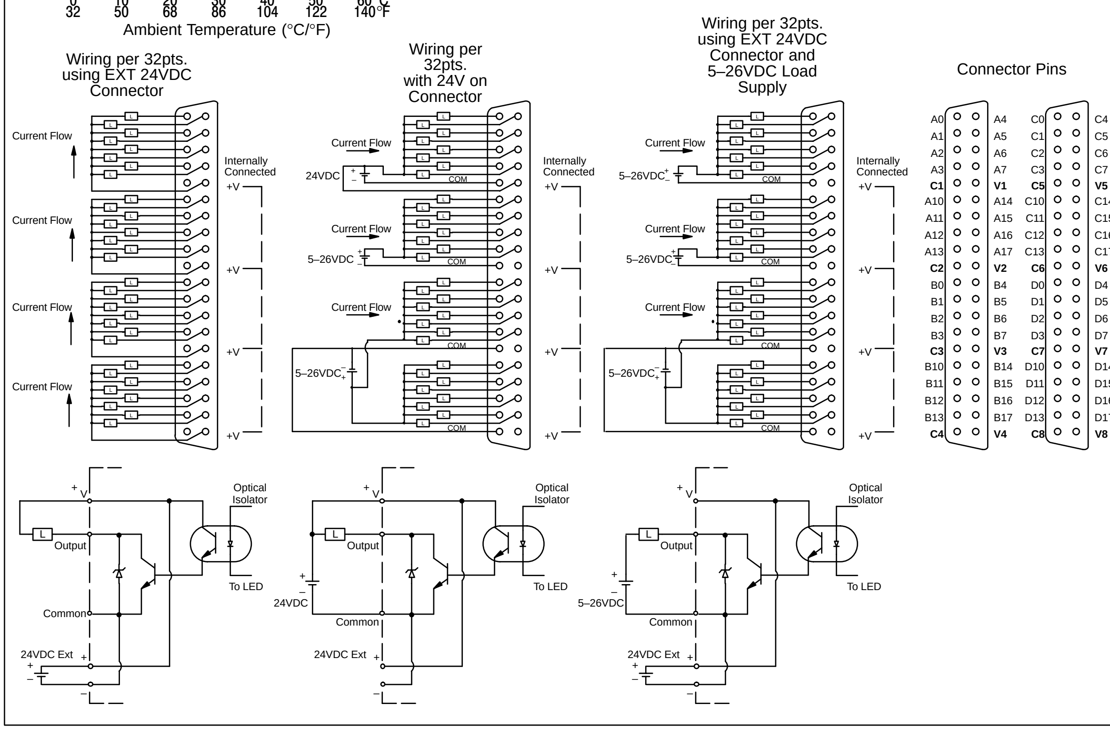
Module Location	CPU base only *	Minimum load	0.1mA
Outputs per module	64 (current sinking)	Base power required 5V	800mA max
Commons per module	8 (isolated)		
Operating voltage	4.75–26.5 VDC		
Output type	NPN Open Collector	External DC required	24VDC ±10%, (800mA + 50mA per common) 7.0A total max
Peak voltage	36 VDC	OFF to ON response	< 0.1 ms
ON voltage drop	0.6 VDC @ 0.1A	ON to OFF response	< 0.2 ms
Max current (resistive)	0.1A / point 1.0A / common 8.0A / module	Terminal type	2, Removable 40-pin connectors (sold sep.)
		Status indicators	Logic Side
Max leakage current	0.01mA @ 36 VDC	Weight	7.4 oz. (210 g)
Max inrush current	1A for 1 ms 700mA for 100 ms	Fuses	None



Only 32 status points can be displayed at one time on the front of the module. In the A - B position the status of the first group of 32 output points (A0–A17, B0–B17) are displayed (connector 1). In the C - D position the status of the second group of 32 output points (C0–C17, D0–D17) are displayed (connector 2).

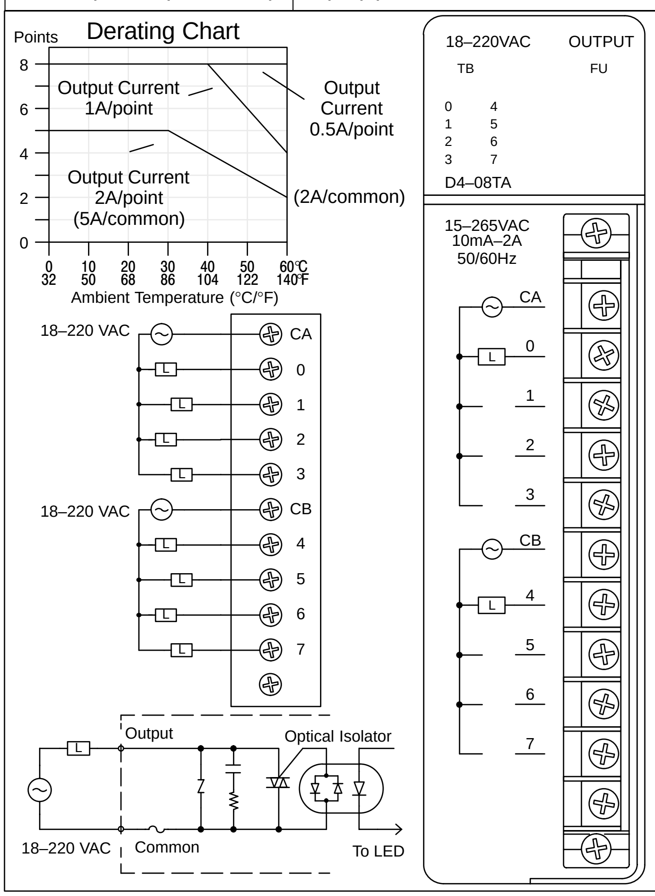
* Module location – this module placement is restricted to the local base on DL430/DL440 systems. It may also be placed in expansion bases in DL450 systems that are using the new (–1) bases.





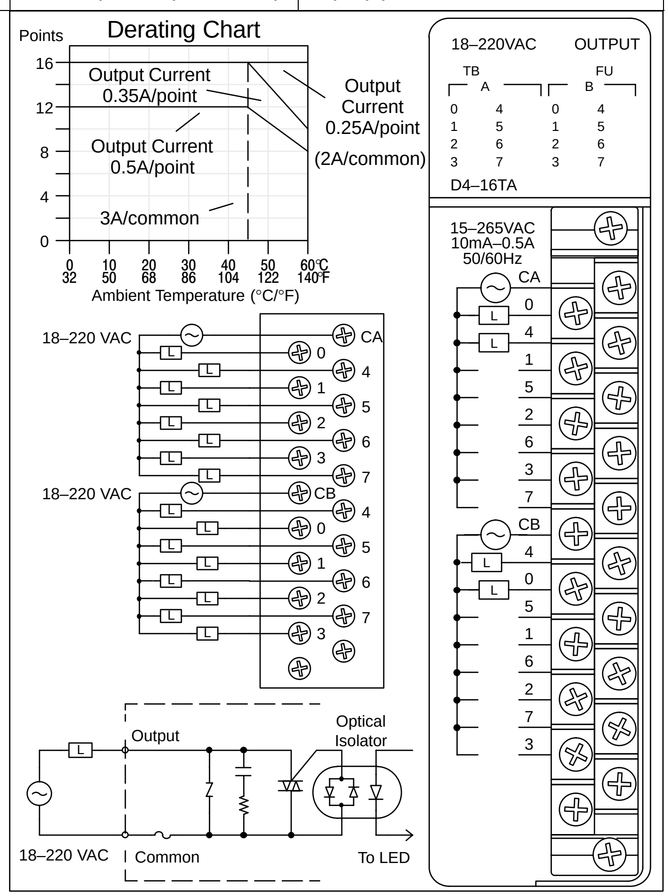
D4–08TA, 18–220VAC Output

Outputs per module	8
Commons per module	2 (isolated)
Operating voltage	15–265VAC
Output type	SSR (triac)
Peak voltage	265VAC
AC frequency	47–63 Hz
ON voltage drop	1.5VAC @ 2A
Max current	2A / point, 5A / com. @ 30°C 2A / common @ 60 °C
Max leakage current	5mA @ 265VAC
Max inrush current	30A for 10 ms, 10A for 100 ms
Minimum load	10 mA
Base power required 5V	250 mA max
OFF to ON response	1 ms
ON to OFF response	1 ms +1/2 AC cycle
Terminal type	Removable
Status indicators	Logic Side
Weight	11.6 oz. (330 g)
Fuses (non-replaceable)	1 (8A) per common



D4–16TA, 18–220VAC Output

Outputs per module	16
Commons per module	2 (isolated)
Operating voltage	15–265VAC
Output type	SSR (triac)
Peak voltage	265VAC
AC frequency	47–63 Hz
ON voltage drop	1.5 VAC @ 0.5A
Max current	0.5A / pt, 3A / common @ 45 °C 2A / common @ 60 °C
Max leakage current	4mA @ 265VAC
Max inrush current	15A for 10 ms, 10A for 100 ms
Minimum load	10 mA
Base power required 5V	450 mA max
OFF to ON response	1 ms
ON to OFF response	1 ms +1/2 AC cycle
Terminal type	Removable
Status indicators	Logic Side
Weight	12.2 oz. (350 g)
Fuses (non-replaceable)	1 (5A) per common

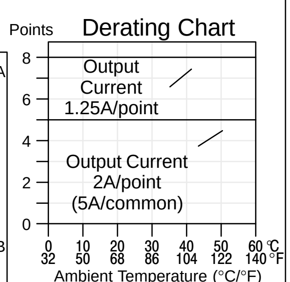


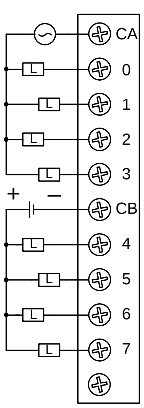
D4–08TR, Relay Output

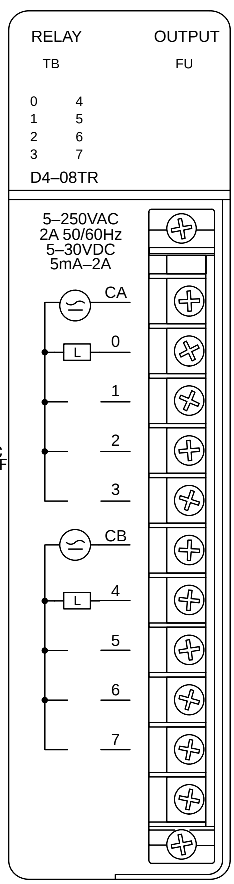
Outputs per module	8 relays
Commons per module	2 (isolated)
Operating voltage	5–30VDC / 5–250VAC
Output type	Form A (SPST–NO)
Peak voltage	30VDC / 256VAC
AC frequency	47–63 Hz
Max current (resistive)	2A / point, 5A / common
Max leakage current	0.1mA @ 265VAC
Max inrush current	2A
Minimum load	5mA
Base power required 5V	550mA max
External DC required	None
OFF to ON response	12 ms
ON to OFF response	12 ms
Terminal type	Removable
Status indicators	Logic Side
Weight	9.1 oz. (260 g)
Fuses (non-replaceable)	1 (8A) per common

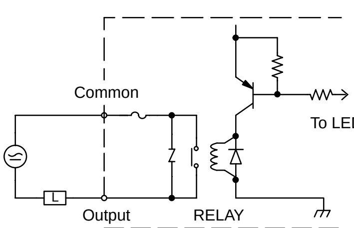
Typical Relay Life (Operations)

Maximum Resistive or Inductive Inrush Load Current	Operating Voltage		
	30VDC	125VAC	250VAC
2A resistive	100K	300K	200K
2A inductive	100K	80K	60K
0.5A resistive	800K	1M	800K
0.5A inductive	300K	300K	200K







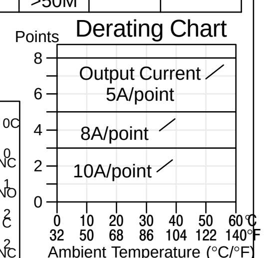


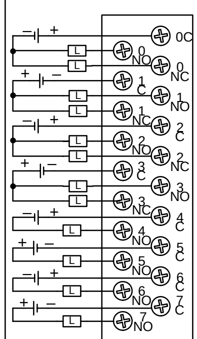
F4–08TRS–1, Relay Output

Outputs per module	8 relays
Commons per module	8 (isolated)
Operating voltage:12–30VDC, 12–125VAC, 125–250VAC*	
Output type: 4, Form C (SPDT), 4, Form A (SPST–NO)	
Peak voltage	30VDC / 250VAC @10A
AC frequency	47–63 Hz
Max current (resistive)	10A / point, 40A / module
Max leakage current	0.1mA @ 265VAC
Max inrush current	10A
Minimum load	100mA @12 VDC
Base power required 5V	575mA max
External DC required	None
OFF to ON response	7 ms
ON to OFF response	9 ms
Terminal type	Removable
Status indicators	Logic Side
Weight	13.2 oz. (374 g)
Fuses (non-replaceable)	1 (10A/125V) per common

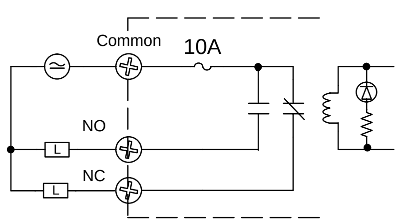
Typical Relay Life (Operations)

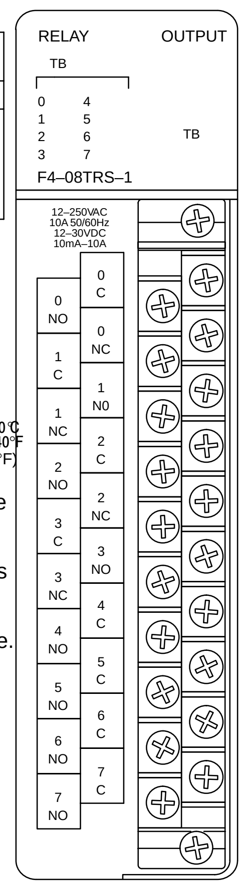
Maximum Resistive or Inductive Inrush Load Current	Operating Voltage		
	30VDC	125VAC	250VAC
1/4 HP		25K	
10.0A	50K	50K	
5.0A	200K	100K	
3.0A	325K	125K	50K
0.5A	>50M		





Maximum DC voltage rating is 120 VDC @ 0.5A, 30,000 cycles typical. Motor starters up to and including NEMA size 3 can be used with this module.



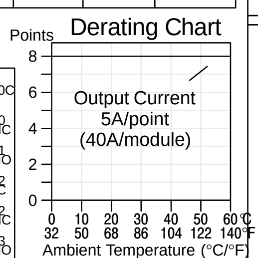


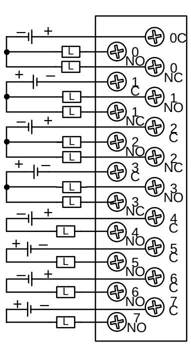
F4–08TRS–2, Relay Output

Outputs per module	8 relays
Commons per module	8 (isolated)
Operating voltage	12–30VDC, 12–250VAC
Output type: 4 Form C (SPDT), 4 Form A (SPST–NO)	
Peak voltage	30VDC / 250VAC @5A
AC frequency	47–63 Hz
Max current (resistive)	5A / point, 40A / module
Max inrush current	10A
Minimum load	100mA @12 VDC
Base power required 5V	575mA max
External DC required	None
OFF to ON response	7 ms
ON to OFF response	9 ms
Terminal type	Removable
Status indicators	Logic Side
Weight	13.8 oz. (390 g)
Fuses, (user replaceable)	1 (10A, 250V) per common 19379–K–10A Wickman

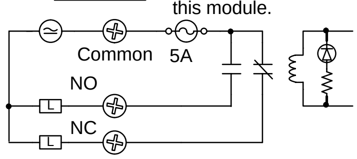
Typical Relay Life (Operations)

Maximum Resistive or Inductive Inrush Load Current	Operating Voltage		
	28VDC	120VAC	240VAC
5.0A 3.0A .05A	200K 325K >50M	100K 125K	50K

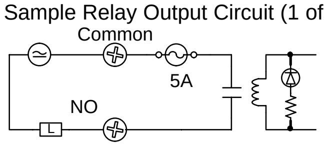




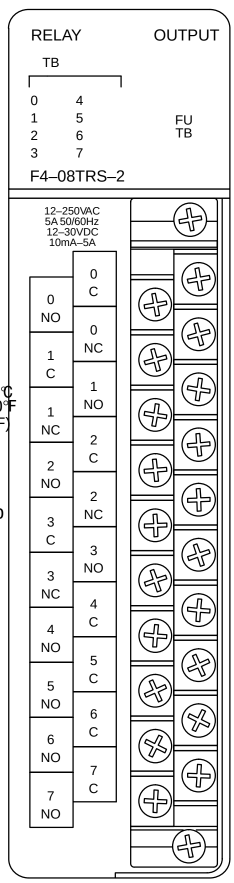
Maximum DC voltage rating is 120 VDC @ 0.5A, 30,000 cycles typical. Motor starters up to and including NEMA size 3 can be used with this module.



Sample Relay Output Circuit (1 of 4)



Sample Relay Output Circuit (1 of 4)

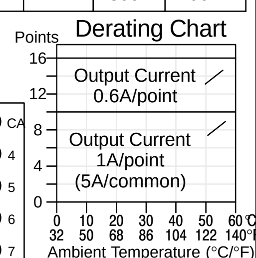


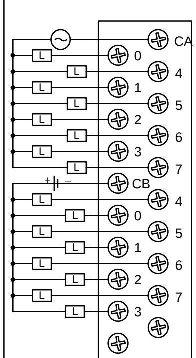
D4–16TR, Relay Output

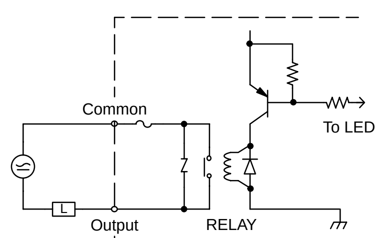
Outputs per module	16 relays
Commons per module	2 (isolated)
Operating voltage	5–30VDC / 5–250VAC
Output type	Form A (SPST–NO)
Peak voltage	30VDC / 256VAC
AC frequency	47–63 Hz
Max current (resistive)	1A / point, 5A / common
Max leakage current	0.1mA @ 265VAC
Max inrush current	4A
Minimum load	5mA
Base power required 5V	1000mA max
External DC required	None
OFF to ON response	10 ms
ON to OFF response	10 ms
Terminal type	Removable
Status indicators	Logic Side
Weight	10.9 oz. (310 g)
Fuses (non-replaceable)	1 (8A) per common

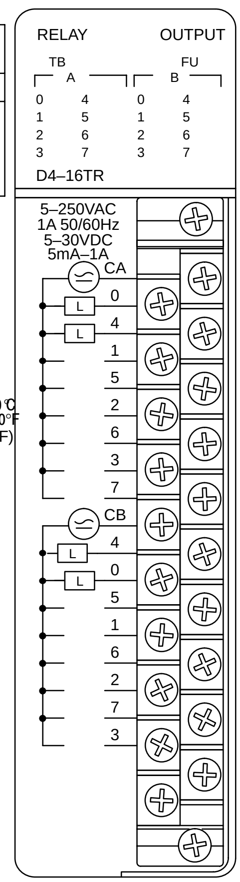
Typical Relay Life (Operations)

Maximum Resistive or Inductive Inrush Load Current	Operating Voltage		
	30VDC	125VAC	250VAC
1A resistive 1A inductive 0.5A resistive 0.5A inductive	>1M 400K >2M >1M	500K 200K 800K 300K	300K 100K 500K 200K









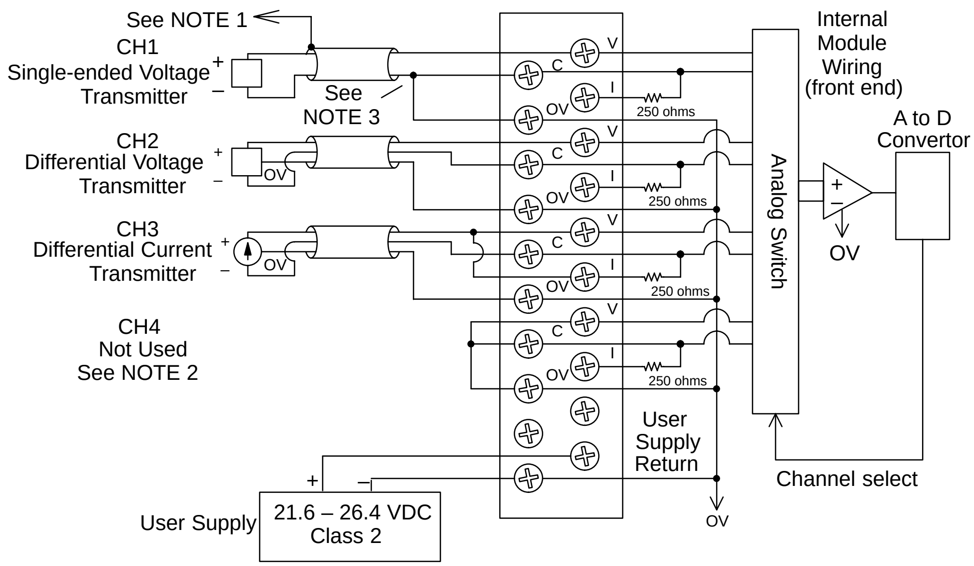
F4–04AD 4–Channel Analog Input

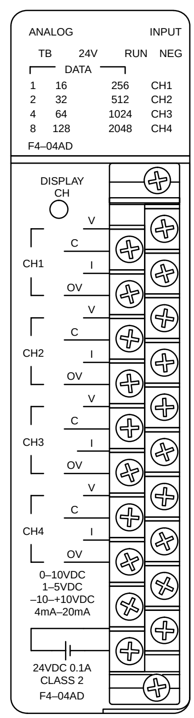
Number of Channels	4
Input Type	Single-ended or differential
Input Ranges	0–5, 1–5, 0–10, ±5, ±10 VDC, 0–20, 4–20 mA.
Resolution	12 bit (0 to 4095), unipolar 13 bit (±4095), bipolar
Input Impedance	20 MΩ minimum, voltage input 250 Ω, 1/2W, ±0.1%, 25 ppm/° C current input
Max. Continuous Overload	±50 VDC, voltage input, ±45 mA, current input
Recommended External Fuse	0.032A, Series 217 fast acting, current inputs
Common Mode Voltage Range	±10V maximum
Linearity	±0.025% of span (±1 count maximum, unipolar)
Input Stability	±1/2 count
Cross Talk	–80 dB, 1/2 count maximum
Full Scale Calibration Error	±12 counts maximum, voltage input ±16 counts maximum, at 20.000 mA current input
Offset Calibration Error	±1 count maximum, voltage input ±2 counts maximum, at 4.000 mA current input
Maximum Inaccuracy	0.4% maximum @ 25°C (77° F) 0.55% maximum @ 0 to 60°C (32 to 140° F)
Conversion Time	< 6 mS per selected channel
Noise Rejection Ratio	Normal mode: –3 dB @ 50 Hz, –6 dB / octave Common mode: –70 dB, DC to 12 kHz

PLC Update Rate	4 channel per scan max.
Digital Input Points Required 16 or 32-bit mode	16 or 32 (X) input points 12 data bits, 4 bits optional for two's complement mode, 4 channel select bits, 12 bits unused in 32 bit mode
Power Budget Requirement	85 mA (power from base)
External Power Supply	24 VDC, ±10%, 100 mA, class 2
Operating Temperature	0 to 60°C (32° to 140° 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
Insulation Resistance	10 MΩ, 500 VDC
Noise Immunity	NEMA ICS3-304

F4–04AD 4–Channel Analog Input Module

NOTE 1: Shields should be grounded at the signal source.
NOTE 2: Unused channels should be shorted for best noise immunity.
NOTE 3: When a differential input is not used, 0V should be connected to C of the channel.





F4–04ADS 4–Channel Isolated Analog Input

Input Specifications

Number of Channels	4
Input Ranges	0–5V, 0–10V, 1–5V, ±5V, ±10V, 0–20 mA, 4–20 mA
Resolution	12 bit (1 in 4096)
Conversion Method	Successive approximation
Input Type	Differential
Max. Common Mode Voltage	±750V peak continuous transformer isolation
Noise Rejection Ratio	Common mode: –100 dB at 60Hz
Active Low-Pass Filtering	–3 dB at 20Hz, –12 dB per octave
Input Impedance	250Ω ±0.1%, 1/2W current input 200KΩ voltage input
Absolute Maximum Ratings	±45 mA, current input ±100V, voltage input
Conversion Time	1 mS per selected channel
Linearity Error	±1 count (0.025% of full scale) maximum
Full Scale Calibration Error	±8 counts maximum (V_{in} = 20 mA)
Offset Calibration Error	±8 counts maximum (V_{in} = 4 mA)

General Specifications

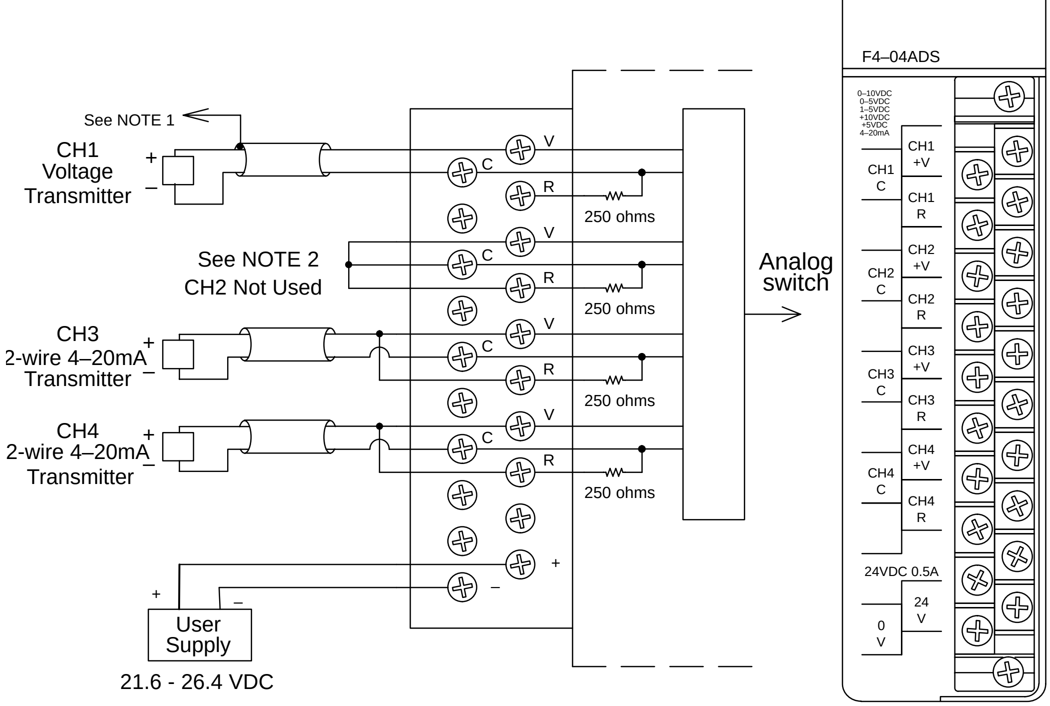
PLC Update Rate	4 channel per scan max.
Digital Input Points Required	12 binary data bits, 4 active channel indicator bits
Accuracy vs. Temperature	±100 ppm / °C maximum full scale (including maximum offset)
Power Budget Requirement	270 mA @ 5 VDC (from base)
External Power Supply	24 VDC, ±10%, 120 mA, class 2
Recommended Fuse	0.032 A, Series 217 fast-acting, current inputs
Operating Temperature	0 to 60°C (32 to 140°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

F4–04ADS 4–Channel Isolated Analog Input Module

Wiring Diagram

NOTE 1: Shields should be grounded at the signal source.

NOTE 2: Unused channels should have V & C & R of the channels jumpered together.



F4–08AD 8–Channel Analog Input

Input Specifications

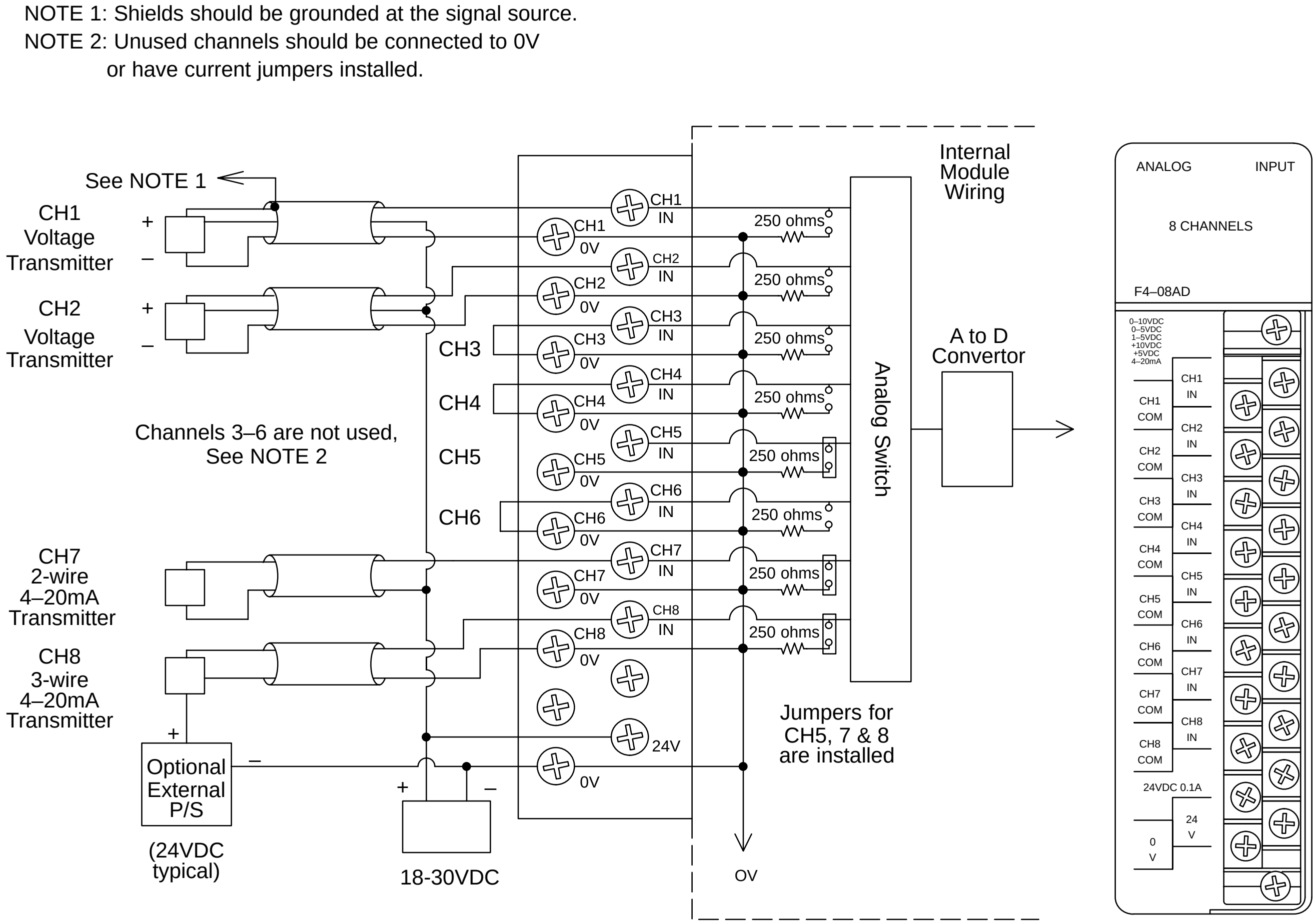
Number of Channels	8, single ended (one common)
Input Ranges	0–5V, 0–10V, 1–5V, ±5V, ±10V, 0–20 mA, 4–20 mA
Resolution	12 bit (1 in 4096)
Active Low-pass Filtering	–3 dB at 20Hz, –12 dB per octave
Input Impedance	250 ohms ±0.1%, 1/2W current input >20 Megohms voltage input, 1 Megohm minimum
Absolute Maximum Ratings	± 45 mA, current input ±75V, voltage input
Conversion Time	0.4ms per channel (module conversion) 1 ms per selected channel minimum (CPU)
Linearity Error (End to End)	±1 count (0.025% of full scale) maximum
Input Stability	±1/2 count
Full Scale Calibration Error (Offset error not included)	±12 counts maximum , voltage input ±12 counts maximum, @ 20mA current input
Offset Calibration Error	±2 counts maximum, unipolar voltage input ±4 counts maximum, bipolar voltage input ±4 counts maximum, 4 mA current input

General Specifications

PLC Update Rate	8 Channel per scan max.
Digital Input Points Required	16 (X) input points total 12 binary data bits, 3 active channel bits,
Power Budget Requirement	75 mA (power from base)
External Power Supply	18–30 VDC, 90 mA, class 2
Recommended Fuse	0.032 A, Series 217 fast-acting, current inputs
Accuracy vs. Temperature	±50 ppm / °C maximum full scale (including maximum offset change of 2 counts)
Operating Temperature	0 to 60°C (32 to 140° F)
Storage Temperature	–20 to 70°C (–4° F 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

One count in the specification table is equal to one least significant bit of the analog data (1 in 4096).

F4–08AD 8–Channel Analog Input Module



More than one external power supply can be used (see channel 8).

If the power supply common of an external power supply is not connected to 0V on the module, then the output of the external transmitter must be isolated. To avoid “ground loop” errors, recommended 4–20mA transmitter types are:

2 or 3 wire: Isolation between input signal and power supply.

4 wire: Isolation between input signal, power supply, and 4–20mA output.

D4–02DA 2–Channel Analog Output

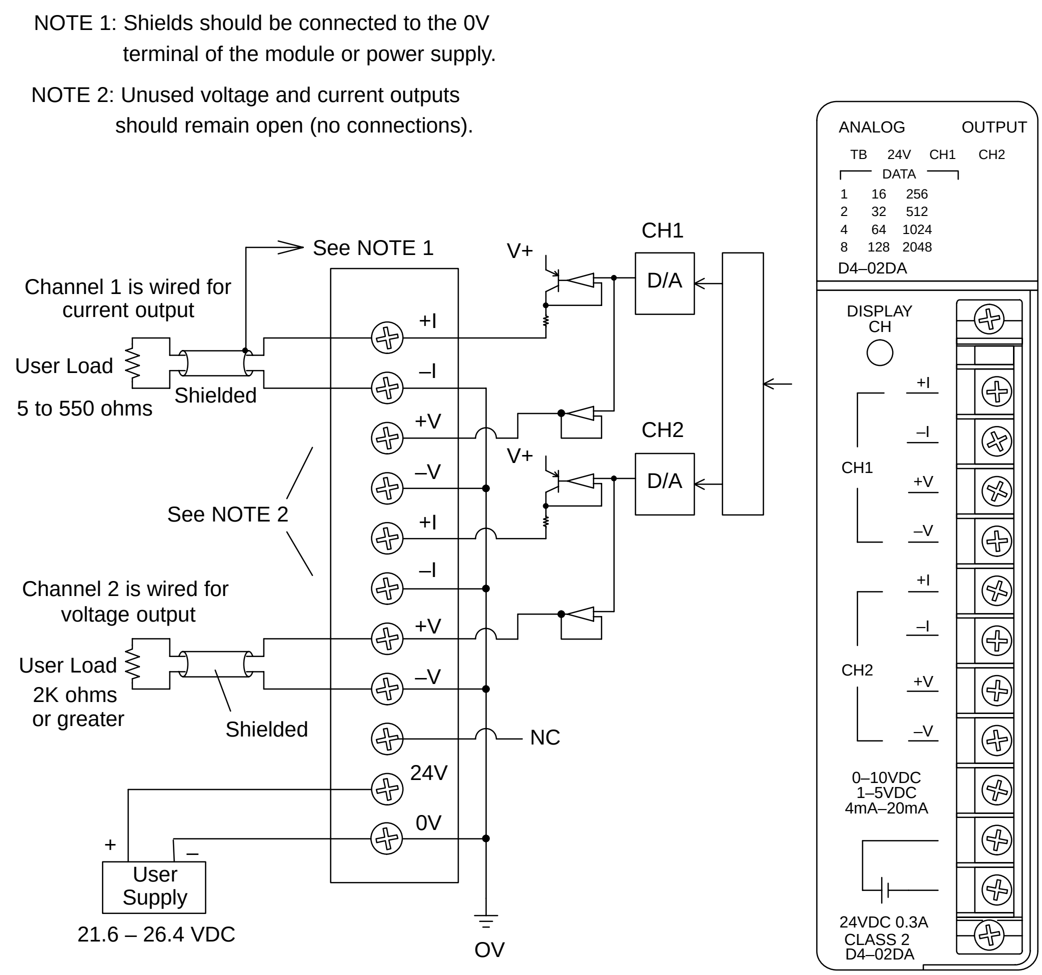
Output Specifications

Number of Channels	2 (independent)
Output Ranges	0–10V, 1–5V, 4–20 mA
Resolution	12 bit (1 in 4096)
Output Type	Single ended
Output Impedance	0.5Ω maximum, voltage output
Output Current	5 mA maximum, voltage output
Load Impedance	550Ω max., 5.0Ω min.,current output, 2KΩ minimum, voltage output
Linearity	±0.1% maximum
Accuracy vs. Temperature	±70 ppm / °C maximum
Maximum Inaccuracy	±0.2% maximum at 25° C
Conversion Method	Integration
Conversion Time	Start of scan, 30µS + one scan

General Module Specifications

PLC Update Rate	1 or 2 channels per scan
Digital Output Points Required	32 (Y) output points 12 binary data bits per channel (24 bits total with 8 unused bits)
Power Budget Requirement	250 mA (from base)
External Power Supply	24VDC, ±10%, 300 mA, class 2
Operating Temperature	0 to 60°C (32 to 140°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
Insulation Resistance	10 MΩ, 500 VDC
Noise Immunity	NEMA ICS3–304

D4–02DA 2–Channel Analog Output Module



F4–04DA 4–Channel Analog Output

Output Specifications

Number of Channels	4
Output Ranges	0–5V, 0–10V, ±5V, ±10V, 4–20 mA
Resolution	12 bit (1 in 4096)
Conversion Method	Successive Approximation
Output Type	Single ended, 1 common
Output Impedance	0.2Ω typical, voltage output
Load Impedance	2KΩ minimum, voltage output 0Ω minimum, current output
Maximum Load / Voltage	680Ω/18V, 1KΩ/24V, 1.5KΩ/36V, current output
Voltage Output Current	5 mA sink or source
Short-Circuit Current	15 mA typical, voltage output
Linearity Error	±1 count (±0.025%) maximum
Gain Calibration Error	±8 counts maximum, voltage output –8 to +11 counts maximum, current output
Offset Calibration Error	±2 counts maximum, voltage output –5 to +9 counts maximum, current output
Conversion Time	5 μs maximum, settling time 0.3 ms maximum, digital out to analog out

General Module Specifications

Digital Output Points Required	16 point (Y) outputs, 12 bits binary data, 4 channel select bits
Power Budget Requirement	120 mA @ 5 VDC (from base)
External Power Supply	24 VDC, 100 mA, class 2 ±10% (add 20 mA for each current loop used)
Accuracy vs. Temperature	±50 ppm / °C maximum full scale ±25 ppm / °C maximum offset
Operating Temperature	0 to 60°C (32 to 140°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

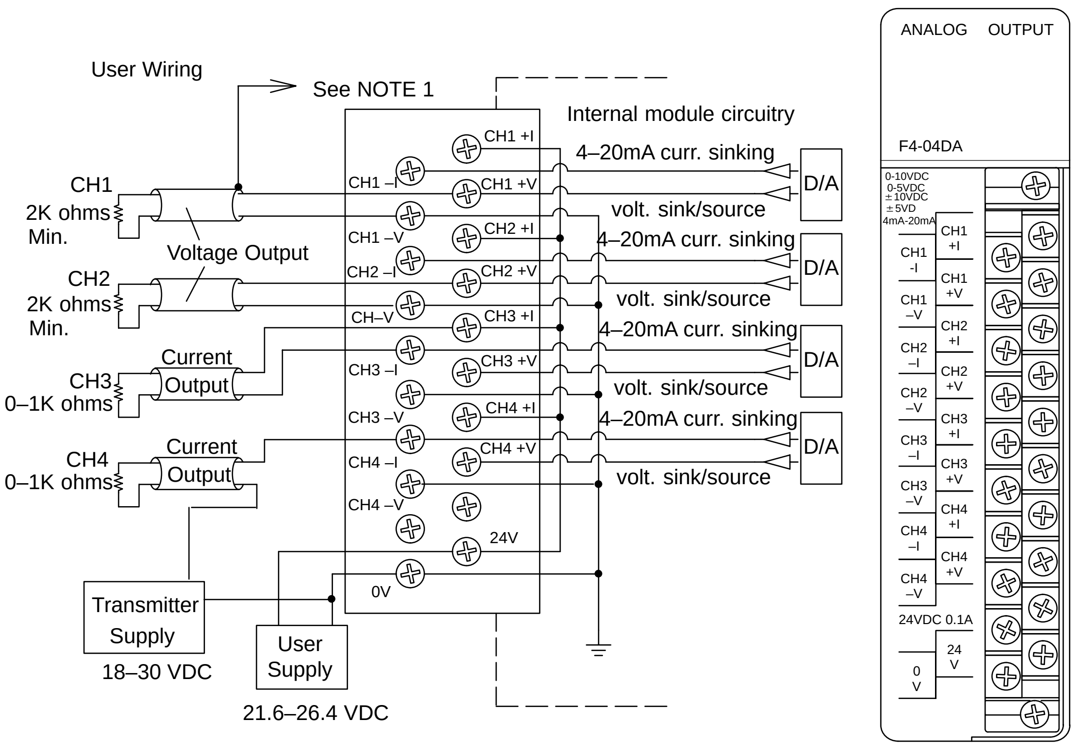
One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096).

F4–04DA 4–Channel Analog Output Module

Wiring Diagram

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

NOTE 2: Unused voltage and current outputs should remain open (no connections).



F4–04DA–1 4–Channel Analog Current Output

Output Specifications

Number of Channels	4, single ended (one common)
Output Range	4–20 mA
Resolution	12 bit (1 in 4095)
Output Type	Outputs sink 4-20 mA from external supply
External Load Resistance	0Ω minimum
Maximum Loop Supply	30 VDC
Peak Output Voltage	40 VDC (clamped, transient suppressed)
Maximum Load / Power Supply	620Ω/18V, 910Ω/24V, 1200Ω/30V
Linearity Error (best fit)	±1 count (±0.025%) maximum
Gain Calibration Error	±5 counts maximum
Offset Calibration Error	±3 counts maximum
Maximum Inaccuracy	±0.1% @ 25°C (77°F) ±0.3% @ 0 to 60°C (32 to140°F)
Conversion Time	100 μs maximum, settling time 2.0 ms maximum, digital out to analog out

General Module Specifications

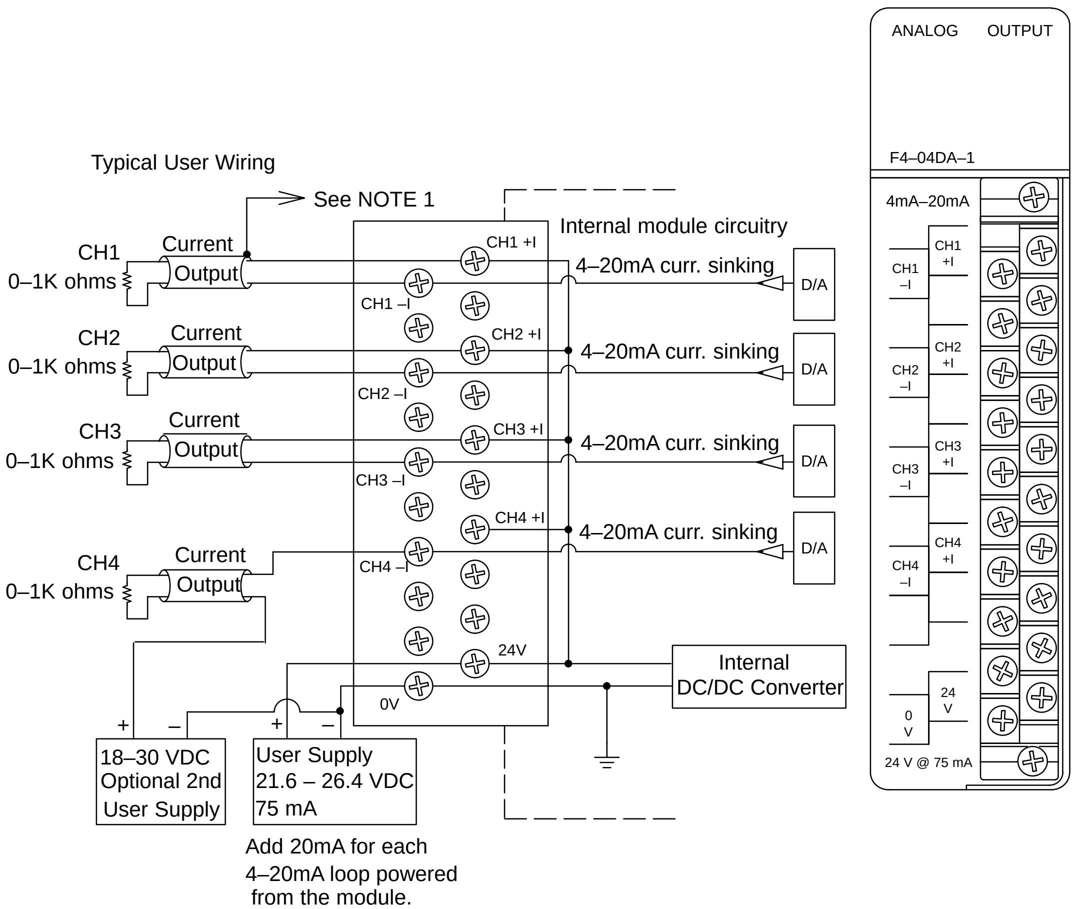
Digital Output Points Required	16 point (Y) outputs, 12 bits binary data and 4 active channel bits
Power Budget Requirement	70 mA @ 5 VDC (from base)
External Power Supply	21.6–26.4 VDC, 75 mA, class 2 (add 20 mA for each current loop used)
Accuracy vs. Temperature	±57 ppm / °C full scale calibration range (including maximum offset change, 2 counts)
Operating Temperature	0 to 60°C (32 to 140°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

F4–04DA–1 4–Channel Analog Current Output Module

Wiring Diagram

NOTE 1: Shields should be connected to the 0V terminal of the module terminal block.

NOTE 2: Unused current outputs should remain open (no connections).



F4–04DA–2 4–Channel Analog Voltage Output

Output Specifications

Number of Channels	4, single ended (one common)
Output Ranges	0–5, 0–10, ±5 , ±10 VDC
Resolution	12 bit (1 in 4095)
Load Impedance	2KΩ minimum
Load Capacitance	0.01 uF maximum
Voltage Output Current	5.0 mA sink or source
Short-circuit Current	15 mA typical
Linearity Error (end to end) and Relative Accuracy	±1 count (±0.025%) maximum
Offset Calibration Error	±3 counts maximum, unipolar ±4 counts maximum, bipolar
Full Scale Calibration Error	±8 counts maximum, (offset error included)
Maximum Inaccuracy	±0.2% @ 25°C (77°F) ±0.4% @ 0 to 60° C (32 to140°F)
Conversion Time	5 µs maximum, settling time 2.0 ms maximum, digital out to analog out

General Module Specifications

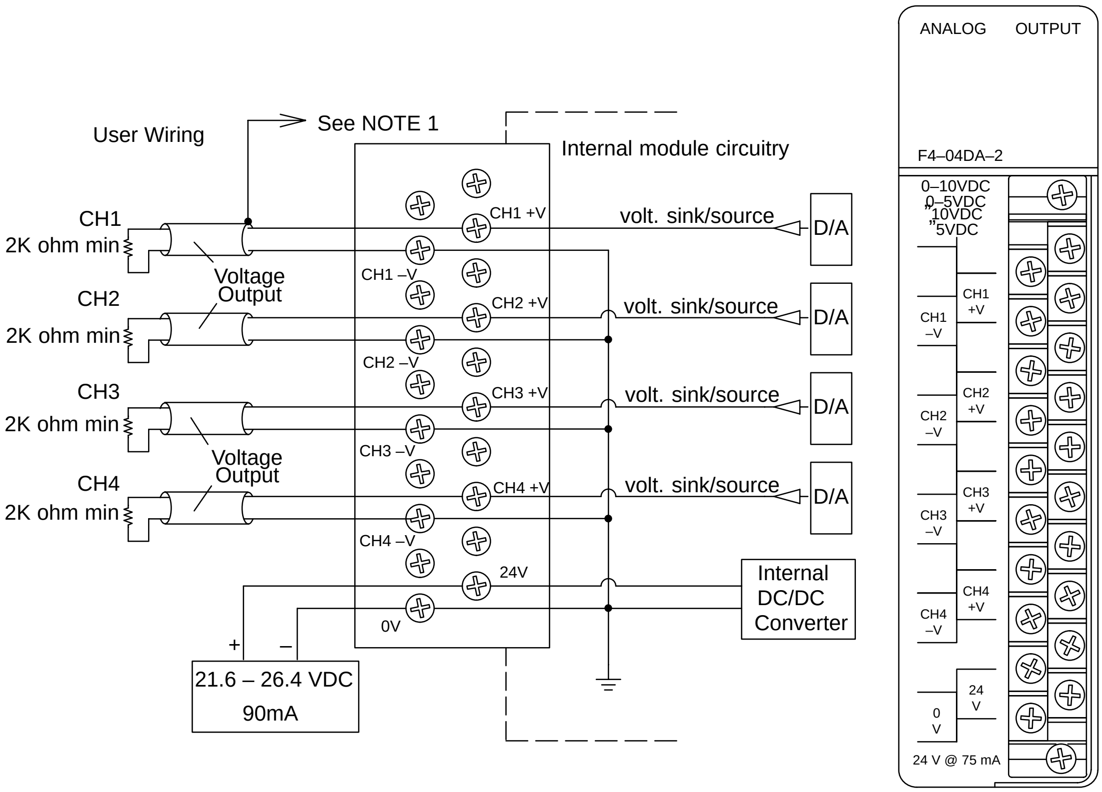
Digital Output Points Required	16 point (Y) outputs, 12 bits binary data, 4 active channel bits or 2 active channel bits and 1 sign bit for bipolar
Power Budget Requirement	90 mA @ 5 VDC (from base)
External Power Supply	21.6–26.4 VDC, 90 mA, class 2 (outputs fully loaded)
Accuracy vs. Temperature	±57 ppm / °C full scale calibration change (including maximum offset change, 2 counts)
Operating Temperature	0 to 60°C (32 to 140°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

F4–04DA–2 4–Channel Analog Voltage Output Module

Wiring Diagram

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

NOTE 2: Unused voltage outputs should remain open (no connections).



F4–04DAS–1 4–Channel 4–20mA Isolated Analog Output

Output Specifications

Number of Channels	4, isolated current sourcing
Output Ranges	4–20mA current
Resolution	16 bit (1 in 65536)
Output Type	Outputs source 4–20 mA from external supply
Isolation Voltage	±750V continuous, channel to channel, channel to logic
Load Impedance	0Ω – 1375Ω
Loop Supply	12–32VDC
Output Loop Compliance	Vin–2.5V
Max. Load/Power Supply	375Ω/12V, 975Ω/24V, 1375Ω/32V
PLC Update Rate	1 channel per scan min., 4 per scan max.
Linearity Error (end to end) and Relative Accuracy	±10 count (±0.015%) maximum
Offset Calibration Error	±13 counts (±0.02%)
Gain Calibration Error	±32 counts maximum, (offset error included)
Maximum Inaccuracy	±0.07% @ 25°C (77°F) ±0.18% @ 0 to 60° C (32 to140°F)
Conversion Time	3ms to 0.1% of full scale

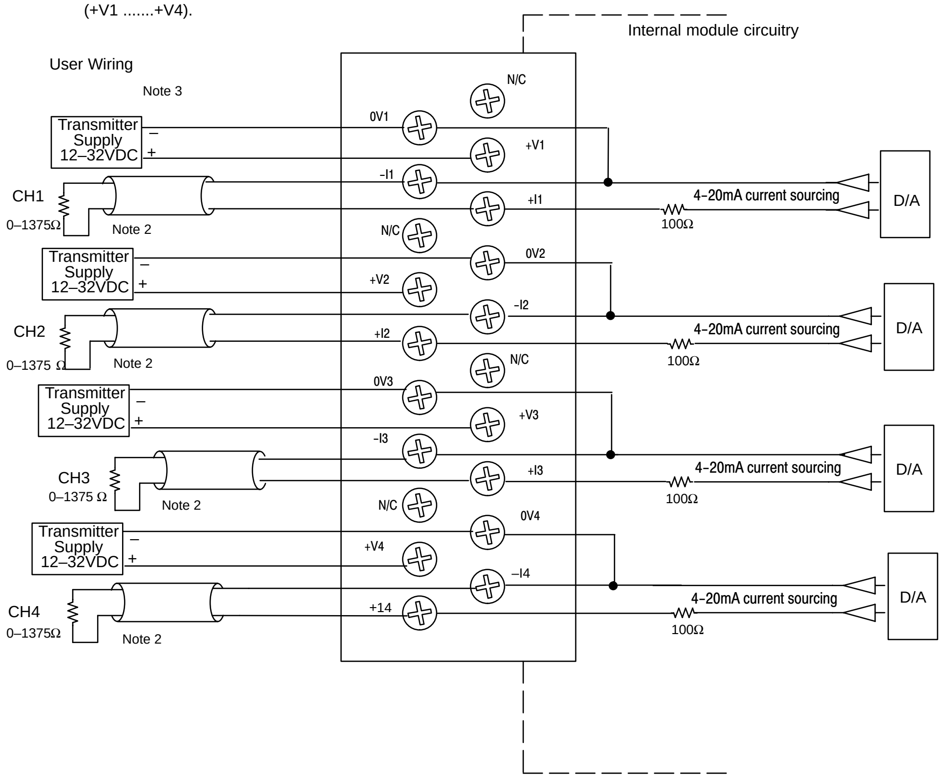
General Module Specifications

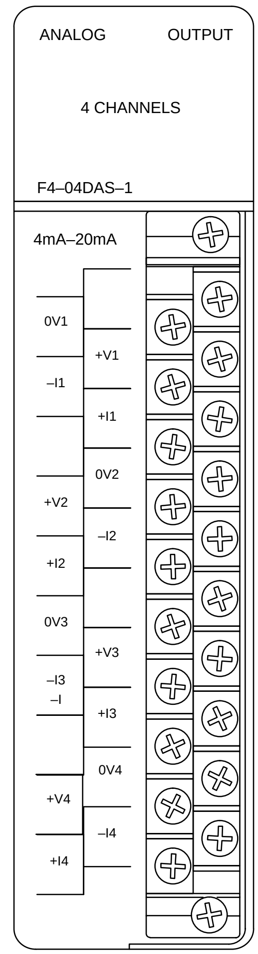
Digital Output Points Required	32 point (Y) outputs, 16 bits binary data, 2 channel identification bits and 1 output enable
Power Budget Requirement	60 mA @ 5 VDC (from base)
External Power Supply	50 mA per channel
Accuracy vs. Temperature	±50 ppm / °C full scale calibration change (including maximum offset change, 2 counts)
Operating Temperature	0 to 60°C (32 to 140°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

F4–04DAS–1 4–Channel 4–20mA Isolated Analog Output Module

Wiring Diagram

NOTE 1: Shields should be connected to the 0V.
NOTE 2: Load must be within compliance voltage.
NOTE 3: For non–isolated outputs, connect all 0V's together (0V1 ....0V4) and connect all +V's together (+V1 ....+V4).





F4–08DA–1 8–Channel Analog Current Output

Output Specifications

Number of Channels	8, single ended (one common)
Output Range	4–20 mA current
Resolution	12 bit (1 in 4095)
Output Type	Outputs sink 4–20 mA from external supply
Peak Output Voltage	40 VDC (no transient voltage suppression)
External Load Resistance	0–480Ω at 18V, 220–740Ω at 24V, 1550–1760Ω at 48V
Maximum Loop Supply	48 VDC (with load resistance in proper range)
Crosstalk	–70 dB, ±1 count maximum
Linearity Error (end-to-end) and Relative Accuracy	±1 count maximum
Full Scale Calibration Error (offset error included)	±8 counts maximum (20mA at 25°C)
Offset Calibration Error	±3 counts maximum (4mA at 25°C)
Maximum Inaccuracy	±0.2% at 25°C (77°F) ±0.4% at 0 to 60°C (32 to140°F)
Conversion Time	400 µs maximum, for full scale change 2.25 to 4.5 mS for digital output to analog out

General Module Specifications

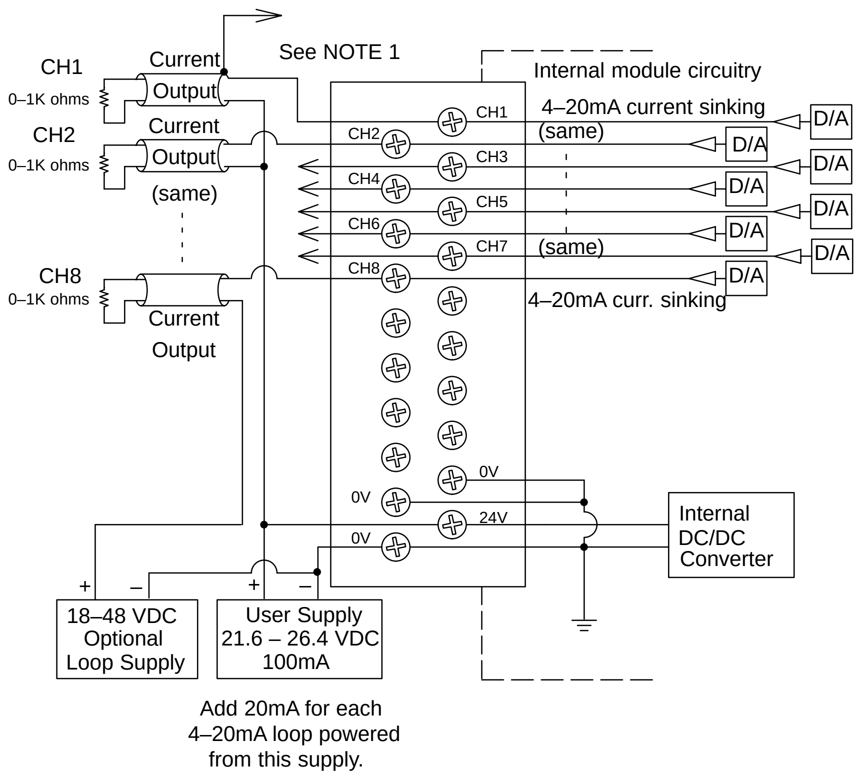
Digital Output Points Required	16 point (Y) outputs, 12 bits binary data, 3 bits channel select, 1 bit output enable
Power Budget Requirement	90 mA at 5 VDC (supplied by base power supply)
External Power Supply	21.6-26.4 VDC, 100 mA, class 2 (add 20 mA for each current loop used)
Accuracy vs. Temperature	±57 ppm / °C full scale calibration range (including maximum offset change, 2 counts)
Operating Temperature	0 to 60°C (32 to 140°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	MIIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3-304

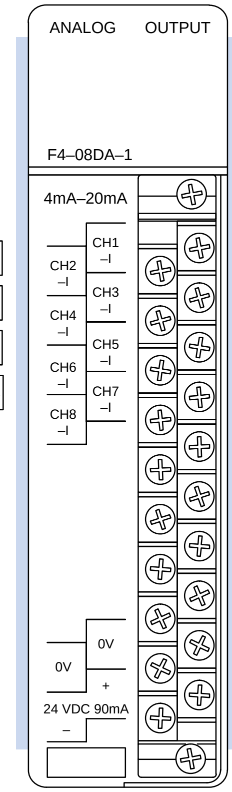
F4–08DA–1 8–Channel Analog Current Output Module

Wiring Diagram

NOTE 1: Shields should be connected to the 0V of the User Power Supply at the module terminal block.
NOTE 2: Unused current outputs should remain open (no connections).

Typical User Wiring





F4–08DA–2 8–Channel Analog Current Output

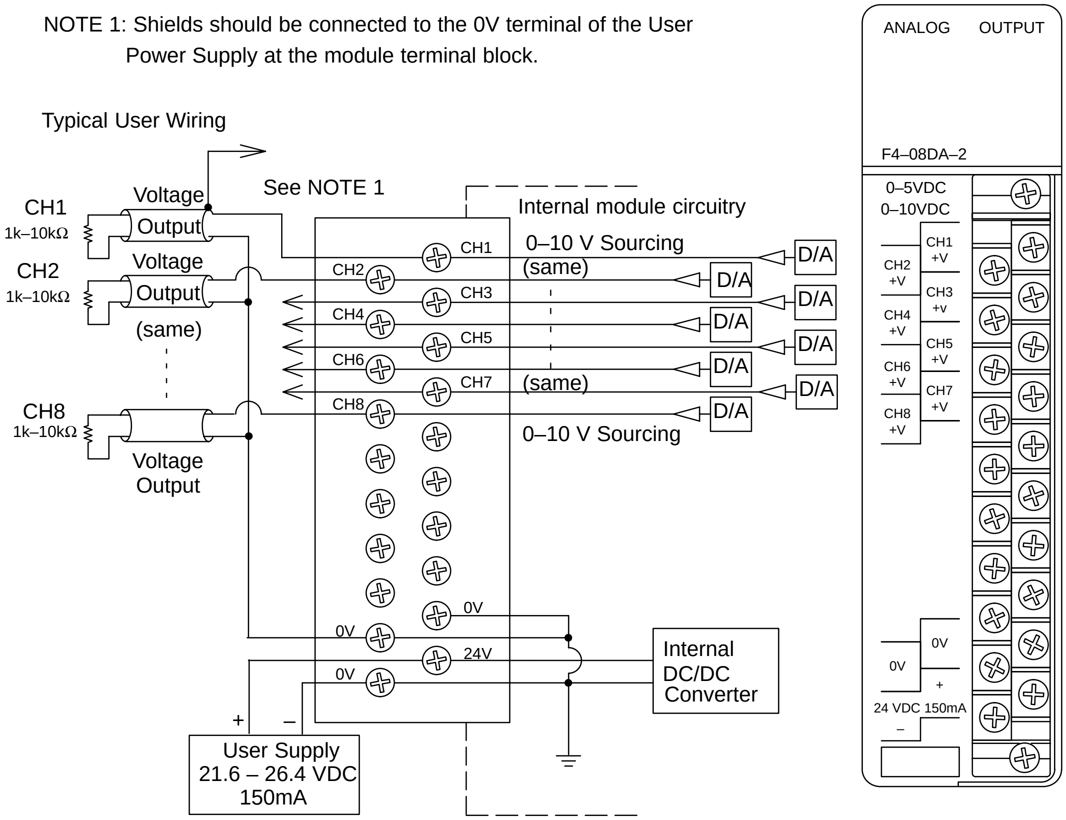
Output Specifications

Number of Channels	8, single ended (one common)
Output Range	0–5VDC, 0–10VDC
Resolution	12 bit (1 in 4095)
Output Type	OVoltage Sourcing 10mA maximum
External Load Resistance	1kΩ maximum /10kΩ minimum
Crosstalk	–70 dB, ±1 count maximum
Linearity Error (end-to-end) and Relative Accuracy	±1 count maximum (10VDC at 25°C)
Full Scale Calibration Error (offset error included)	±6 counts maximum (10VDC at 25°C)
Offset Calibration Error	±3 counts maximum (0VDC at 25°C)
Maximum Inaccuracy	±0.2% at 25°C (77°F) ±0.4% at 0 to 60°C (32 to140°F)
Conversion Time	400 μs maximum, for full scale change 4.5 to 9 mS for digital output to analog out

General Module Specifications

Digital Output Points Required	16 point (Y) outputs, 12 bits binary data, 3 bits channel select, 1 bit output enable
Power Budget Requirement	80 mA at 5 VDC (supplied by base power supply)
External Power Supply	21.6-26.4 VDC, 150 mA, class 2 (add 20 mA for each current loop used)
Accuracy vs. Temperature	±57 ppm / °C full scale calibration range (including maximum offset change, 2 counts)
Operating Temperature	0 to 60°C (32 to 140°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	MIIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3-304

F4–08DA–2 8–Channel Analog Voltage Output Module



F4–16DA–1 16–Channel Analog Current Output

Output Specifications

Number of Channels	16, single ended (one common)
Output Range	4–20 mA current
Resolution	12 bit (1 in 4095)
Output Type	Outputs sink 4–20 mA from external supply
Peak Output Voltage	40 VDC (no transient voltage suppression)
External Load Resistance	0–480Ω @ 18V, 220–740Ω @ 24V, 1550–1760Ω @ 48V
Maximum Loop Supply	48 VDC (with load resistance in proper range)
Crosstalk	–70 dB, ±1 count maximum
Linearity Error (end-to-end) and Relative Accuracy	±1 count maximum (20mA at 25°C)
Full Scale Calibration Error (offset error included)	±8 counts maximum (20mA at 25°C)
Offset Calibration Error	±3 counts maximum (4mA at 25°C)
Maximum Inaccuracy	±0.2% @ 25°C (77°F) ±0.4% @ 0 to 60°C (32 to 140°F)
Conversion Time	400 μs maximum, for full scale change 4.5 to 9 mS for digital output to analog out

General Module Specifications

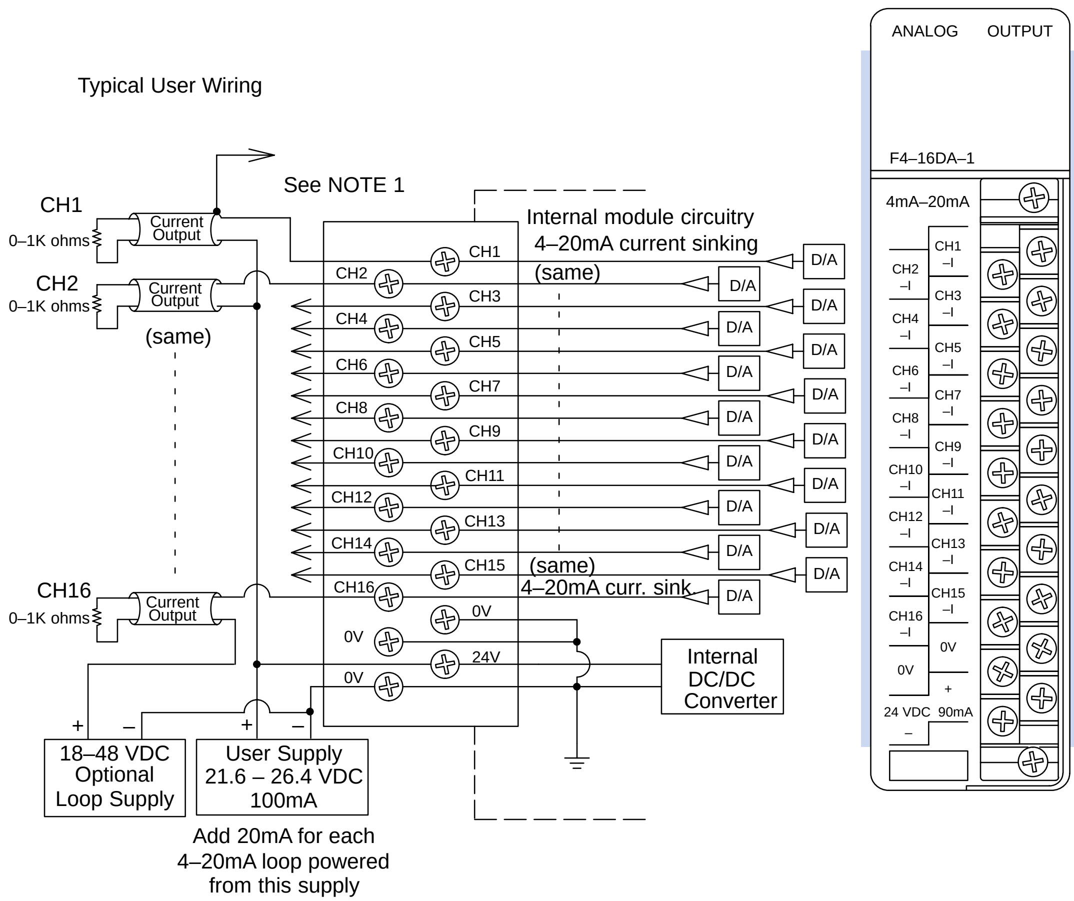
Digital Output Points Required	32 point (Y) outputs, 2 sets each of 12 bits binary data, 3 bits channel select, 1 bit output enable
Power Budget Requirement	90 mA @ 5 VDC (supplied by base)
External Power Supply	21.6 – 26.4 VDC, 100 mA, class 2 (add 20 mA for each current loop used)
Accuracy vs. Temperature	±57 ppm / °C full scale calibration range (including maximum offset change, 2 counts)
Operating Temperature	0 to 60°C (32 to 140°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

F4–16DA–1 16–Channel Analog Current Output Module

Wiring Diagram

NOTE 1: Shields should be connected to the 0V of the User Power Supply at the module terminal block.

NOTE 2: Unused current outputs should remain open (no connections).



F4–16DA–2 16–Channel Analog Voltage Output

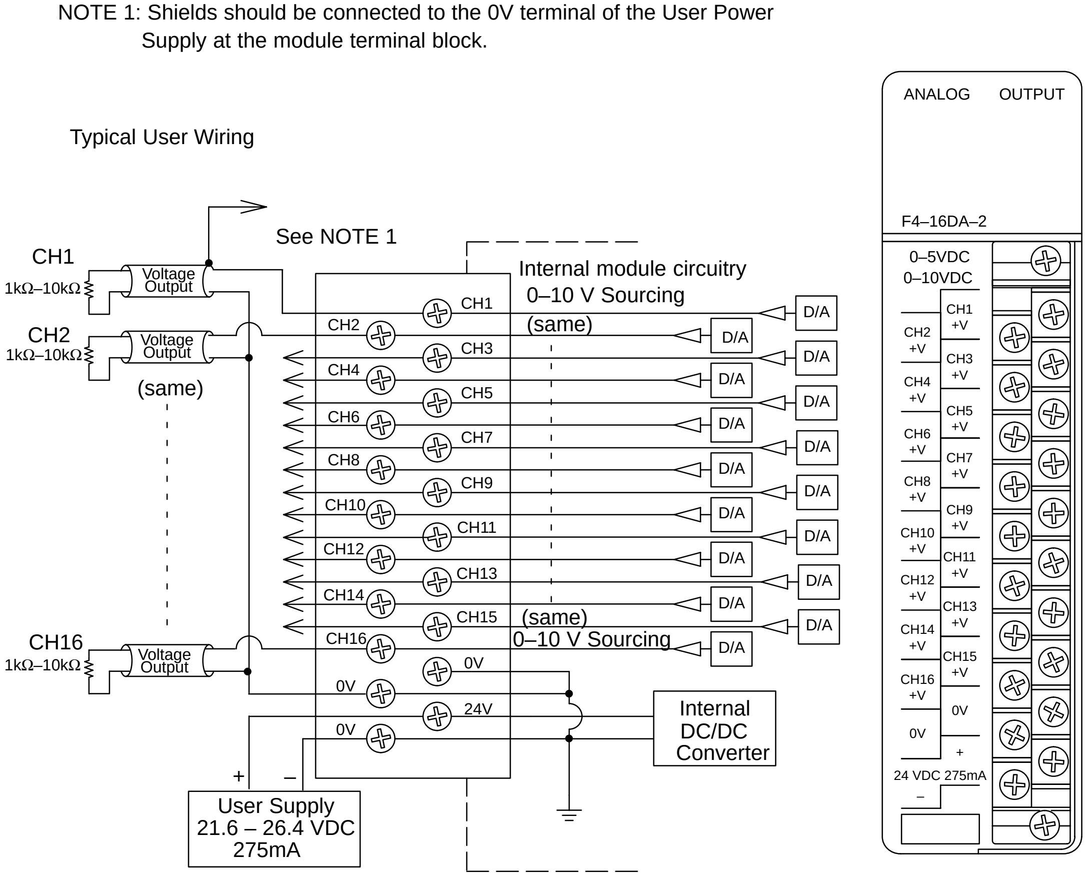
Output Specifications

Number of Channels	16, single ended (one common)
Output Range	0–5VDC, 0–10VDC
Resolution	12 bit (1 in 4095)
Output Type	Voltage Sourcing 10mA maximum
External Load Resistance	1kΩ maximum /10kΩ minimum
Crosstalk	–70 dB, ±1 count maximum
Linearity Error (end-to-end) and Relative Accuracy	±1 count maximum (10VDC at 25°C)
Full Scale Calibration Error (offset error included)	±6 counts maximum (10VDC at 25°C)
Offset Calibration Error	±3 counts maximum (0VDC at 25°C)
Maximum Inaccuracy	±0.2% at 25°C (77°F) ±0.4% at 0 to 60°C (32 to140°F)
Conversion Time	400 μs maximum, for full scale change 4.5 to 9 mS for digital output to analog out

General Module Specifications

Digital Output Points Required	32 point (Y) outputs, two sets each of 12 bits binary data, 3 bits channel select, 1 bit output enable
Power Budget Requirement	80 mA at 5 VDC (supplied by base power supply)
External Power Supply	21.6-26.4 VDC, 150 mA, class 2 (add 20 mA for each current loop used)
Accuracy vs. Temperature	±57 ppm / °C full scale calibration range (including maximum offset change, 2 counts)
Operating Temperature	0 to 60°C (32 to 140°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	MIIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	NEMA ICS3-304

F4–16DA–2 16–Channel Analog Voltage Output Module



F4–08THM 8–Channel Thermocouple Input

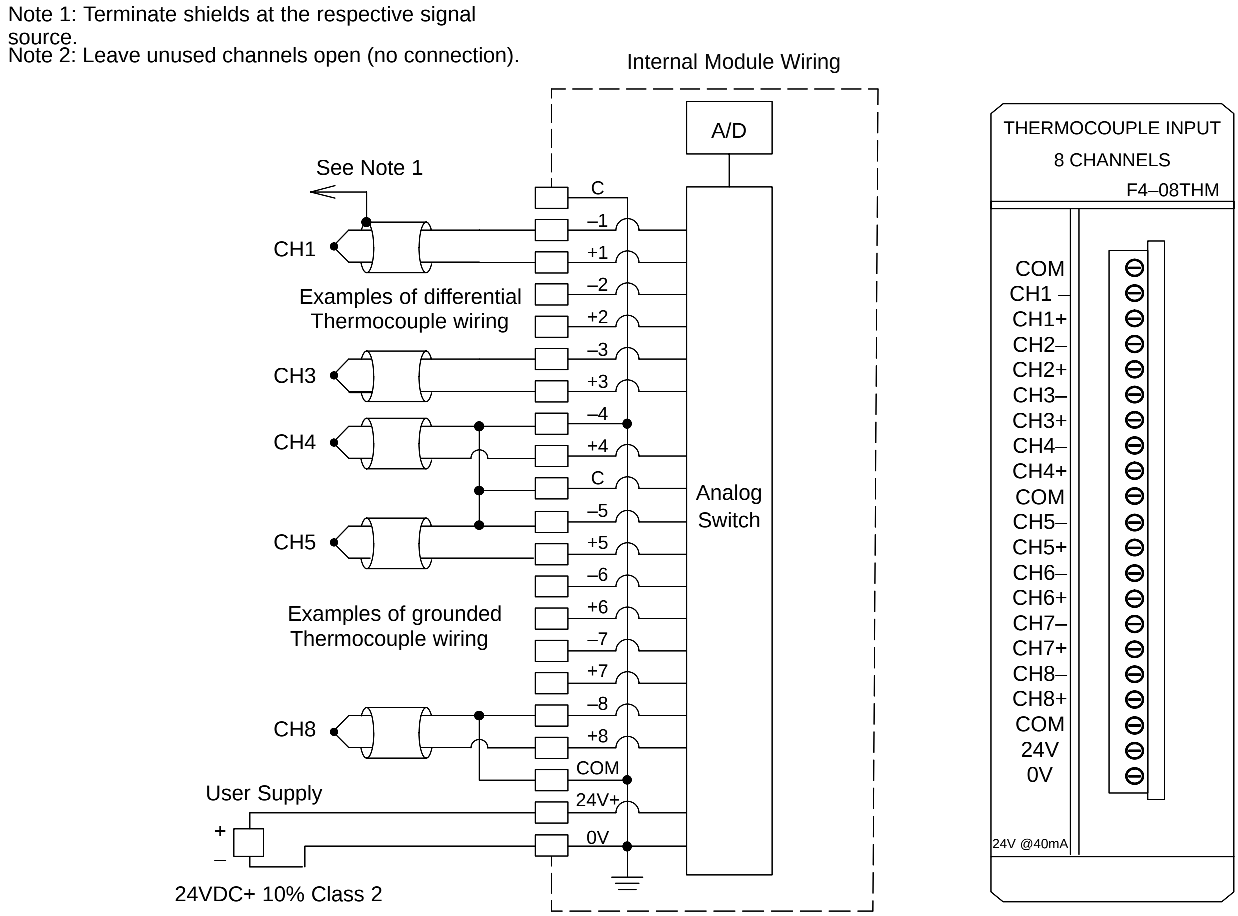
Input Specifications

Number of Channels	8, differential inputs
Input Ranges	Type J: –190/760 °C, –310/1400 °F Type E: –210/1000 °C, –346/1832 °F Type K: –150/1372 °C, –238/2502 °F Type R: 65/1768 °C, 149/3214 °F Type S: 65/1768 °C, 149/3214 °F Type T: –230/400 °C, –382/752 °F Type B: 529/1820 °C, 984/3308°F Type N: –70/1300 °C, –94/2372°F Type C: –65/2320 °C, –146/4208 °F
Display Resolution	±0.1° C or ±0.1° F
Input Impedance	1MΩ
Absolute Maximum Ratings	Fault-protected input, ±50 VDC
Cold Junction Compensation	Automatic
Conversion Time	100ms per channel, minimum
Linearity Error	±.05° C maximum, ±.01° C typical
Full Scale Calibration Error	±13 counts typical, ±33 counts max.
Maximum Inaccuracy*	±.02% @ 25° C

General Specifications

PLC Update Rate	8 channel per scan max.
Digital Input Points Required	16 (X) input points, including , 2 channel ID bits, 4 diagnostic bit
Power Budget Requirement	110 mA @ 5 VDC (from base)
External Power Supply	60 mA maximum, 18 to 26.4VDC
Operating Temperature	0° to 60° C (32° to 140° F)
Storage Temperature	–20° to 70° C (–4° to 158° F)
Accuracy vs. Temperature	±57 ppm / °C maximum full scale
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

F4–08THM 8–Channel Thermocouple Input Module



F4–08THM–n 8–Channel Thermocouple Input

Input Specifications

Number of Channels	8, differential inputs
Input Ranges	Type E: –270/1000 °C, –450/1832 °F Type J: –210/760 °C, –350/1390 °F Type K: –270/1370 °C, –450/2500 °F Type R: 0/1768 °C, 32/3214 °F Type S: 0/1768 °C, 32/3214 °F Type T: –270/400 °C, –450/752 °F Type C: 60/2320 °C, 149/4208°F Type B: 529/1820 °C, 984/3594°F Type P: –99/1395 °C, –146/2543 °F –1: 0–50 mV –2: 0–100 mV –3: 0–25 mV
Resolution	12 bit (1 in 4096)
Input Impedance	27KΩ DC
Absolute Maximum Ratings	Fault-protected input, 130 Vrms or 100 VDC
Cold Junction Compensation	Automatic
Conversion Time	15ms per channel, minimum 1 channel per CPU scan
Converter Type	Successive approximation
Linearity Error	± 1 count (0.03% of full scale) maximum
Full Scale Calibration Error	0.35% of full scale
Maximum Inaccuracy*	± 1° C type J,K,E,T thermocouples ± 3° C type R,S,B,C,P thermocouples

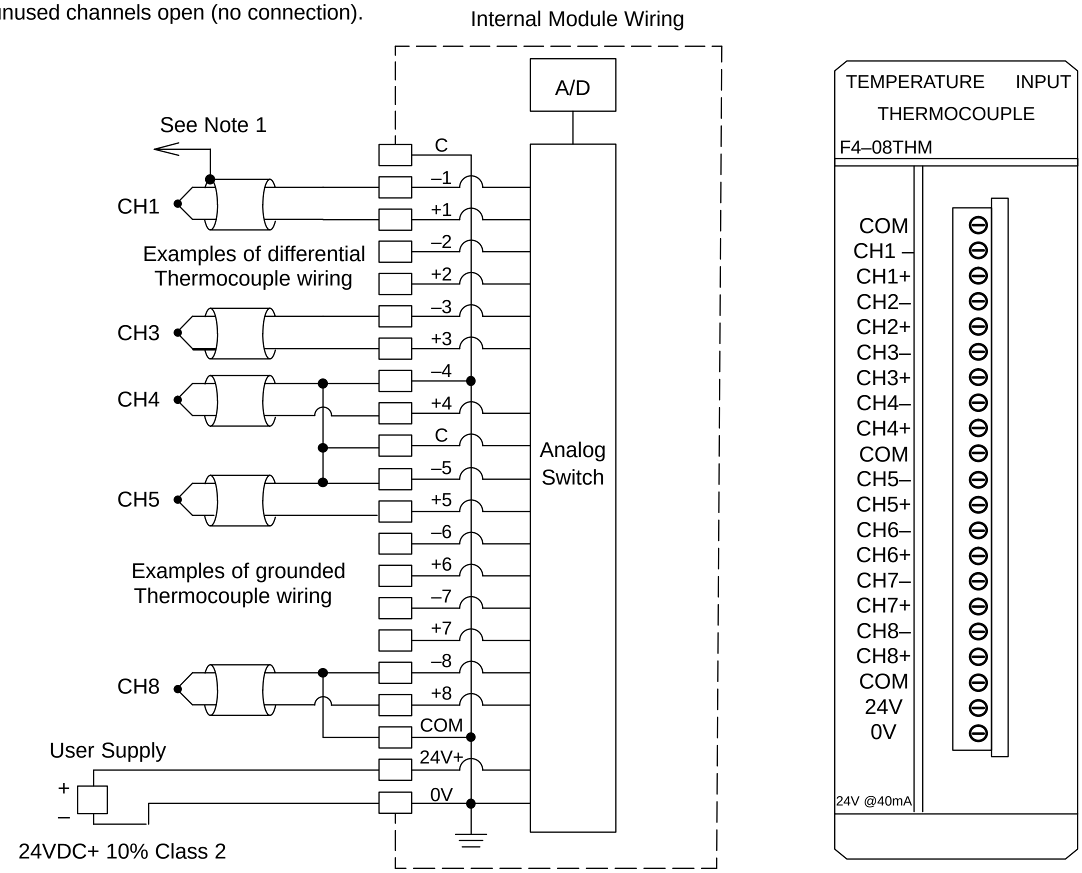
* Maximum Inaccuracy is guaranteed for temperatures above –220°C for types E, T, J, and K, and above +100°C for types R and S.

General Specifications

PLC Update Rate	8 channel per scan max.
Digital Input Points Required	16 (X) input points, including 12 binary data bits, 3 channel ID bits, 1 sign bit
Power Budget Requirement	120 mA @ 5 VDC (from base)
External Power Supply	24 VDC ± 10%, 50 mA current
Operating Temperature	0° to 60° C (32° to 140° F)
Storage Temperature	–20° to 70° C (–4° to 158° F)
Accuracy vs. Temperature	± 57 ppm / °C maximum full scale
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

F4–08THM–n 8–Channel Thermocouple Input Module

Note 1: Terminate shields at the respective signal source.
Note 2: Leave unused channels open (no connection).



F4–08RTD 8–Channel RTD Input

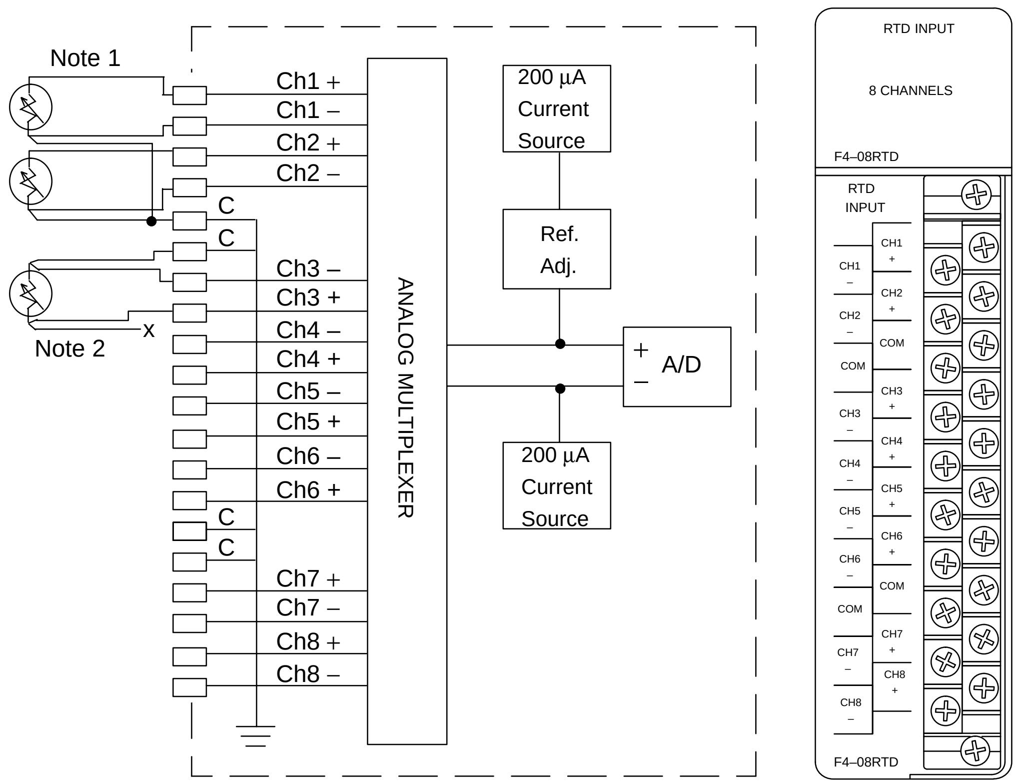
Input Specifications

Number of Channels	8 differential inputs
Input Ranges	Pt100 –200°C/850°C (–328°F/1562°F) Pt 1000 –200°C/595°C (–328°F/1103°F) jPt100 –38°C/450°C (–36°F/842°F) 10ΩCu. –200°C/260°C (–328°F/500°F) 25ΩCu. –200°C/260°C (–328°F/500°F)
Display Resolution	±0.01 °C, ±0.01 °F (±3276.7)
Resolution	15-bit (1 in 32768)
Absolute Maximum Ratings	Fault-protected input, ±22 VDC
Converter Type	Charge balancing, 24-bit
Sampling Rate	160 msec per channel
Temperature Drift	±5ppm per °C (maximum)
Common Mode Range	0–5 VDC
Linearity Error	±.05° C maximum, ±.01° C typical
Full Scale Calibration	±1° C

General Specifications

PLC Update Rate	8 Channels/Scan max. DL440/DL450 CPUs 1 Channel/Scan max. DL430 CPU
Digital Input Points Required	32 (X) input points, 16 binary data bits, 3 channel ID bits, 8 fault bits
Power Budget Requirement	80 mA @ 5 VDC (from base)
Operating Temperature	0° to 60°C (32° to 140°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

F4–08RTD 8–Channel RTD Input Module



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 a RTD sensor has four wires, the extra plus (+) sense wire should be left unconnected as shown.