

# Discrete Input Modules

## IC697MDL671

GFK-0880D

March 2010

Interrupt Module, 14 Point, 24 Volt DC Positive/Negative Logic

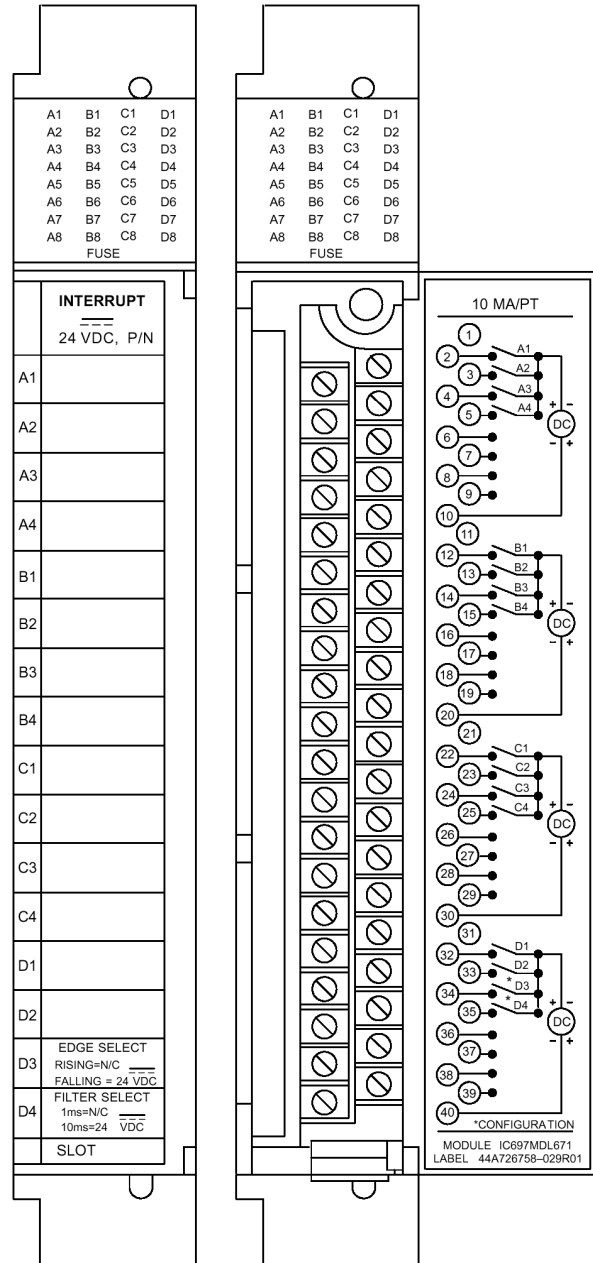
### Features

- 16 Points – Four isolated groups of 4 points each
- 14 interrupt points; 2 configuration points
- Positive/Negative Logic Compatibility
- Proximity switch compatible
- Input filter selectable – 1ms or 10ms
- All 14 interrupts can run at maximum I/O interrupt rate.

### Functions

The **24 Volt DC Positive/Negative Logic Interrupt Input Module** provides 16 points total in four isolated groups of four points each. The first 14 points (A1 through D2) are interrupt inputs and the last 2, D3 and D4 are configuration inputs. The input current-voltage characteristics meet IEC standard (type 1) specifications.

LED indicators that show the ON-OFF status of each point are located at the top of the module.



Operation of the 24 Volt DC Positive/Negative Interrupt Module

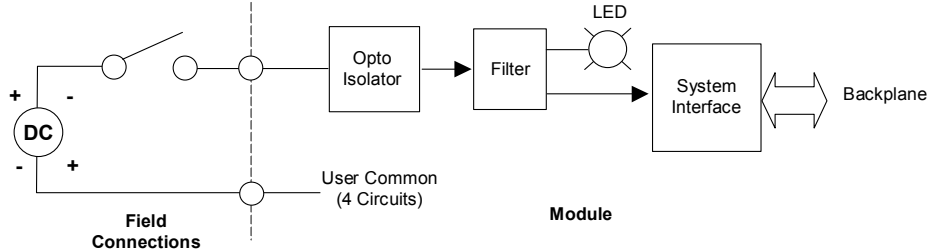


Figure 1. Block Diagram for IC697MDL671

This interrupt module generates an interrupt to the PLC, allowing the execution of an interrupt block, when any or of its 14 interrupt inputs satisfies its configured edge and filter selection. All interrupts are reported as one word at the module’s selected reference address. The PLC reads the interrupt word and acknowledges the interrupt. The module is then ready to generate the next PLC interrupt.

To use this module with an IC697 CPU that is running software earlier than Release 6.00, ladder logic must be added to the application program to perform the above functions. Example ladder logic is provided in datasheet GFK-2269. It is also available for download from GEFanuc.com, as *gfk671.zip*

Interrupts are edge-triggered and require a minimum pulse width (as configured) for the trigger to occur. Interrupts on a single input may not occur at a frequency greater than 500Hz, depending on CPU type. For example:

Minimum Interrupt Burst (1 ms Filter Selection) <i>Single Point:</i> with IC697CPM915 CPU at 1 second PLC Watchdog Setting	500 Hz
with IC697CPU731 CPU at 2.5 seconds PLC Watchdog Setting	290 Hz
Minimum Throughput * Interrupt Input to Discrete Output Response with IC697CPM915 CPU and IC697MDL740 Output Module with DOIO Function	1.5 ms

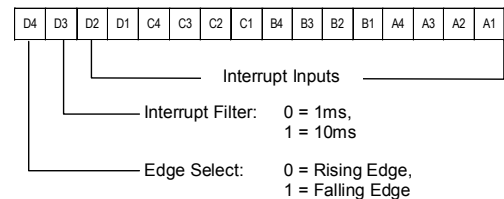
\* Amount of user logic in the interrupt block may affect performance.

Within the module, interrupts are reported as they are received; all interrupts have equal priority. Multiple interrupts may be reported simultaneously.

Input Data Format

Each interrupt input corresponds to a bit in the module’s input word. The interrupt word also provides two bits that can be used to set up edge detection and interrupt filter delay for the module, as described below.

Input Bits



Edge Detection and Interrupt Filter Time

The module defaults to *rising edge trigger* and *1ms interrupt filter*.

Inputs D3 and D4 can be used to configure edge detection and interrupt filter time for all 14 interrupt inputs. Inputs D3 and D4 are read only at power-up.

Activating input D3 reconfigures the module (after a power cycle) for falling edge detection.

Activating input D4 reconfigures the module (after a power cycle) for a 10ms interrupt filter.

Interrupt Default States

At power-up, default data is present at the module’s configured %I references, regardless of the level of each interrupt input. The default data for rising edge selection is all zeros; the default data for falling edge selection is all

ones. The level of the configuration bits detected at power-up is also present in the default word.

### Interrupt Reporting

An interrupt received on any of the 14 interrupt inputs causes an interrupt to be sent to the CPU. The CPU reads the interrupt module and captures the interrupt conditions at the time the CPU interrupt was generated. This data is written to the %I reference that has been configured for the module. Current interrupt data is valid within the interrupt block only.

Modules configured for positive edge trigger report a 1 for active interrupts while negative edge interrupts report a 0 for active interrupts. The interrupt handling logic must reference the %I data to determine which subset of the interrupt points are active.

Two examples of interrupt reports are shown below.

#### RISING EDGE

D4	D3	D2	D1	C4	C3	C2	C1	B4	B3	B2	B1	A4	A3	A2	A1
1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0

D4 = 10 ms Filter Select  
D3 = Rising Edge Select  
A2 = Positive Interrupt

#### FALLING EDGE

D4	D3	D2	D1	C4	C3	C2	C1	B4	B3	B2	B1	A4	A3	A2	A1
0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1

D4 = 1 ms Filter Select  
D3 = Falling Edge Select  
B4 = Negative Interrupt

### I/O Triggered Interrupt Block

Each interrupt module can cause an event-triggered program block to be scheduled for execution. The trigger must be the first %I reference configured for the module. For example, an Interrupt module configured at %I0001 must be programmed to execute a program block triggered by %I0001.

### Interrupt Handling Logic

Any application logic you have developed for an interrupt module should be contained in the interrupt-handling logic associated with that module. Logic outside of the interrupt handling logic will have no meaningful data to act upon. *The interrupt bits and associated transitions are undefined outside of the interrupt handling logic.*

If the interrupt handling logic is an interrupt block within the ladder logic program, then the global %I contacts and/or %I transition contacts can be referenced to determine which interrupt points are active.

If the interrupt handling logic is an event-triggered standalone C program, the %I word should be included in the program's input specification list. This data can then be referenced using the input specification macros to determine which interrupt points are active. Refer to the *C Programmer's Toolkit Reference Manual* for more information.

Note: Referencing the global %I data directly from within a standalone C program is not recommended because the global data may not reflect the state of the %I bits at the time the interrupt occurred.

If the interrupt handling logic is an event-triggered ladder logic program, the global %I data can be referenced to determine which interrupt points are active. However, this is not recommended because the global %I data may not reflect the state of the %I bits at the time that the interrupt occurred.

Refer to the *PLC Reference Manual* for your system for more information on interrupt handling logic.

### Interrupt Buffer

Interrupts received while the CPU is processing a previous interrupt are stored in a buffer. When the CPU acknowledges the previous interrupt, the module immediately generates a new CPU interrupt to report all of the buffered interrupts. For buffered interrupts, data is not available about the number of interrupts received on a single input. Information about the order in which interrupts from different inputs occurred is also not available for buffered interrupts.

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### Important Module Information

- Interrupt modules cannot be used in a Remote I/O Scanner rack because a remote drop *cannot* have any I/O module interrupts.
- If a DOIO instruction is used with an I/O interrupt, transition contacts associated with scanned inputs may not operate as expected.
- When using the Mask/Unmask I/O Interrupt Service Request #17 (SVCREQ #17), the mask applies to all interrupts on the module. When entering the address of the interrupt to mask, use the first %I reference of the module.

#### Caution

**Caution should be exercised since an I/O interrupt can interrupt the execution of a function block in the main block or any program block. This means that unexpected results may occur if the interrupt block and a program block access the same data.**

### Input Characteristics

This module has both positive and negative logic characteristics. It sinks or sources current from input devices to the user common. The input device is connected between the power bus and the module input as shown in Figure 1.

This module is compatible with a wide variety of input devices, such as:

- Pushbuttons, limit switches, selector switches
- Electronic proximity switches, both 2-wire and 3-wire

In addition, inputs on this module may be directly driven by a compatible voltage output module.

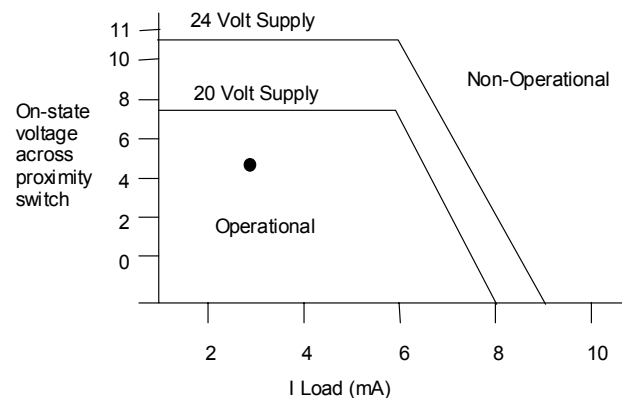
The input circuitry provides sufficient current to ensure reliable operation of the switching device. Input current is typically 10mA in the ON state, and can accept up to 2mA leakage current in the OFF state without turning on.

### Proximity Switch Compatibility

3-wire proximity switches are easily applied, since they provide low voltage drop in the ON state and low leakage current in the OFF State.

2-wire proximity switches derive their power from the signal connections; thus both the ON state voltage and the OFF state leakage current are higher than for 3-wire devices. This module is designed to be compatible with many such 2-wire devices; however each device type must be carefully evaluated for compatibility in both the ON and OFF states.

To determine compatibility with a specific proximity switch, find the ON state characteristics of the switch in the diagram shown below. If that point falls to the left of the input load line, the ON state characteristics are compatible. As an example, the ON state requirements of a compatible proximity switch of 3mA at 5 volts drop are shown below. OFF state compatibility is assured if the proximity switch leakage is less than 2mA with a module input voltage of 5 volts or less.

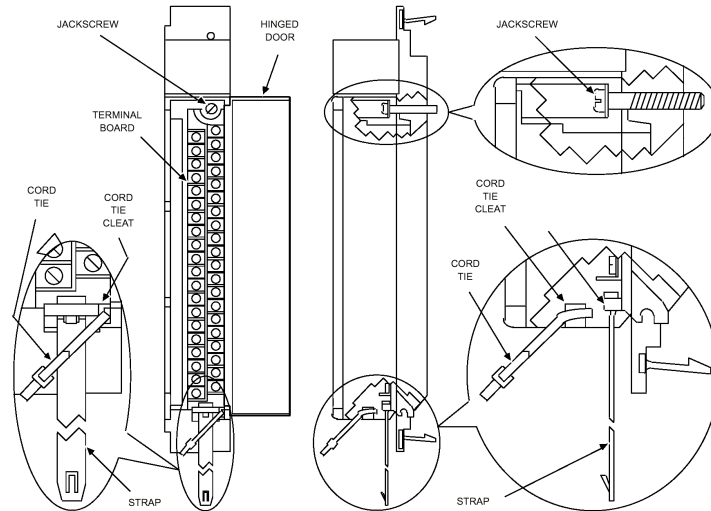


### Module Keying

Earlier versions of this module included a mechanical key to prevent inadvertently replacing a module with another of the wrong type. The key latched onto the backplane center rail when the module was first installed, and remained on the backplane if the module was removed.

A new module without this keying feature can be installed in a previously-keyed slot without removing the earlier keying. However, the key is easily removed by pushing it upward to unhook the latch while pulling it off the rail.

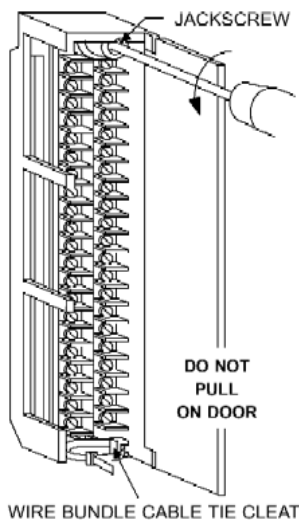
**Module Features**



**Recommended Field Wiring Procedures**

The following procedures are recommended when connecting field wiring to the detachable terminal board on this input module.

1. Turn off power before removing or installing terminal boards.
2. Open the hinged door on the module. The terminal board can be removed by turning the jackscrew counter-clockwise until it is disengaged.



3. To remove the terminal board, grasp the top of the terminal board and swing it outward.

**Caution**

**Do not use the hinged door to remove the terminal board. The door could be damaged if this is done.**

4. The terminal board accepts wire sizes from AWG #22 (0.36 mm<sup>2</sup>) through AWG #14 (2.10 mm<sup>2</sup>). When using AWG #14 (2.10 mm<sup>2</sup>) wire for wiring all points, do not exceed a maximum insulation diameter of 0.135 inch (3.43mm). To ensure proper connection, two wires may be terminated on one terminal only if both wires are the same size.
5. The terminal board accepts a maximum of 40 AWG #14 (2.10 mm<sup>2</sup>) wires. If AWG #14 (2.10 mm<sup>2</sup>) wires are used, place wire at least 8 inches (203mm) from termination end to provide space for the hinged door to close. After completing connections to all modules in a rack, the wire bundle must be secured. To ensure that the wire bundle is secured properly, it is recommended that a cable tie be wrapped around the wire bundle and tightly secured through the cable tie cleat at the bottom of the terminal board. For extremely large wire bundles, additional cable ties should be used.
6. The module's door label shows circuit wiring information and provides space to record circuit wiring identification. A slot is provided on the hinged door to allow for insertion of this label. If the

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label is difficult to insert, crease the scored edge before insertion.

- Field wiring connections are shown below. Since each group of four inputs is isolated from the others, a wire from the power source to the power input terminal for each group (terminal number 10, 20, 30, or 40) is required (power input terminals for each group are not connected to each other inside the module).

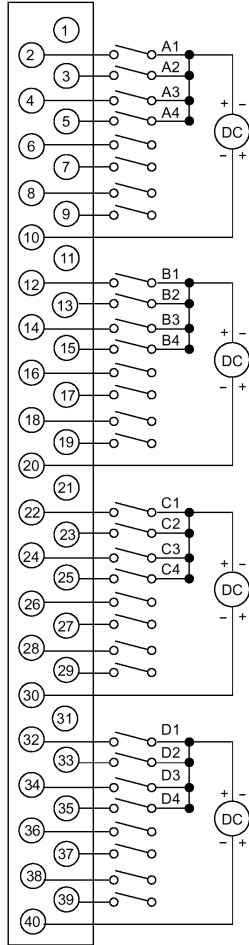


Figure 2. Field Wiring Connections for IC697MDL671

- After field wiring is completed, fasten the terminal board to the rack by inserting the terminal board strap (attached to each module) into the small rectangular slots in the bottom card guide grill on the rack. This strap not only secures the terminal board to the rack, it also provides a way of identifying the wired terminal board with its rack slot location.
- For adequate module ventilation, it is recommended that at least a 6 inch (152mm) clearance be allowed above and below the rack grill. Wire bundles should not obstruct the rack grill.

### Removing an I/O Module

The instructions below should be followed when removing an I/O module from its slot in a rack.

- Grasp the board firmly at the top and bottom of the board cover with your thumbs on the front of the cover and your fingers on the plastic clips on the back of the cover.
- Squeeze the rack clips on the back of the cover with your fingers to disengage the clip from the rack rail and pull the board firmly to remove it from the backplane connector.
- Slide the board along the card guide and remove it from the rack.

Table 1. Specifications for Module IC697MDL671

<b>Rated Voltage</b>	24 volts DC
<b>Inputs per Module</b>	14 interrupts (total of 16 inputs with four groups of four inputs each)
<b>Isolation</b>	1500 volts RMS – any input to backplane 500 volts RMS between input groups
<b>Input Voltage Range (V<sub>s</sub>)</b>	-3 to +30 volts DC
<b>Input Current</b>	10mA (typical) at rated voltage
<b>Input Impedance</b>	2.6K ohm, typical
<b>Input Characteristics –</b>	
<b>On-state Voltage</b>	Positive: 13.5 volts to 30 volts
<b>Off-state Voltage</b>	Positive: -3 volts to 5 volts
<b>On-state Current</b>	6mA to 15mA
<b>Off-state Current</b>	0 to 2mA (2mA min. at 5V input)
<b>Filter Delay Time</b>	1 ms or 10 ms configurable
<b>Minimum Pulse Width</b>	1 ms Filter Select: 1 ms on and off 10 ms Filter Select: 11 ms on and off
<b>Current Required from 5VDC backplane bus</b>	0.30 amp

For installations requiring compliance to more stringent requirements (for example, FCC or European Union Directives), refer to GFK-1179, *Installation Requirements for Conformance to Standards*.

Table 2. Ordering Information

Description	Catalog Number
Interrupt Input Module, 24 Volt DC Positive/Negative Logic, 14 interrupt points	IC697MDL671

Note: For Conformal Coat option, or Low Temperature Testing option please consult the factory for price and availability.