8 DO 24Vdc Fail-Safe Mod. with Isolation Barrier PO2025

Doc. Code: CE109405 Revision: C

Product Description

Module PO2025 is part of Ponto Series and has 8 fail-safe digital output, source type and common supply. It has an isolation barrier between the output points and the system bus. It is suitable for applications were supervision of the field wiring is needed, being able to indicate open load, open circuit, short-circuit and over current. The module has diagnosis functions to guarantee proper work of outputs.

The picture shows the product assembled on a PO6002 spring type terminal base.

Main characteristics are:

- Output type: current source (MOSFET transistor)
- Redundant output switch to guarantee fail-safe behavior with outputs in off state
- Possibility to use two outputs in parallel to drive the same field device to increase availability. Diodes are built-in
- Short-circuit and over-load protection
- Protection diode for inductive loads
- Fail causes diagnosis
- Hot-swap without touching field wiring
- Field wiring connected to terminal base allowing direct connection without intermediate connections
- Local and remote diagnosis indication
- Automatic addressing
- Digital signature to be identified by bus master

Ordering Information

Included Items

Product package contains the following items:

- PO2025 module
- Installation guide

Product Coding

Use the following code when ordering the product:

Code	Description
PO2025	8 Digital Outputs 24Vdc Fail-safe Module with Isolation Barrier

Related Products

Depending on requirements, the following products might be ordered along with the PO2025 module:

Code	Description
PO6002	Digital I/O spring terminal base with common power line
PO8510	10 sheets with 14 labels of 16 tags for printer
PO8522	End bracket for rail
PO8523	Spring terminal tool
AL-1532	Full range 24 Vdc power supply 3 A
AL-1533	24 Vdc Power supply 5 A

Characteristics

	PO2025
Module Type	8 Digital Outputs 24Vdc Fail-safe Module with Isolation Barrier
Nominal current per point	1,25 A per point @ 40 °C 1 A per point @ 60 °C 1 A per redundant output point with diode @ 60 °C (see note 1)
Maximum total current per module	10 A @ 40 °C 8 A @ 60 °C 8 A total when used redundant outputs with diodes @ 60 °C (see note 2)
Maximum current limit	1,5 A (± 10%) per point (see note 3)
Minimum current limit	30 mA (± 25%) per point (see note 4)
Output groups	2 groups, output 0 to 3 in one group and 4 to 7 in another (see note 5)
Supply voltage	19 to 30 Vdc (ripple included)
Current consumption from 24Vdc field power supply	120 mA by internal circuit (see note 6)
Output type	Transistor, source type (see note 7)
Output maximum impedance	250 mΩ
Output state switching time	50 µs maximum (see note 8)
State indication	One LED per output point
Diagnosis indication	One multifunctional LED with indication of module OK, module not accessed, missing external power supply, open load or short-circuit in outputs One SAFE LED indicating that protections are enabled and are not active Each point LED indicate diagnosis to the output in case of problem
Operation modes	Safe Mode, with all protections enabled Normal Mode, with protections disabled or partially enabled
Configurable parameters	Unused points, tests enabling, test pulses duration (see note 9)
Hot-swap	Yes
Protections	Protection against over current and short-circuit, inverted power supply and protection diode to inductive loads
Redundancy	Outputs may be used in parallel to 1oo2D operation using outputs with internal diode (see note 10)
Isolation Barrier **Outputs to bus** **Outputs to ground** **Between outputs**	 1500 Vac 1 minute, 250 Vac continuous 1500 Vac 1 minute, 250 Vac continuous Not isolated
Current consumption from bus	30 mA
Power dissipation	4,5 W with nominal current
Operation temperature	0 to 60 °C (see notes 1 and 2)
Dimensions	100 x 52 x 84 mm
Standards	IEC 61131-2
Bases	PO6002

Compatible programming software	Master Tool MT4100 3.85 or greater ProPonto MT6000 1.45 or greater
Compatible CPU	PO3042 revision AR or greater PO3142 revision AS or greater PO3242 revision AQ or greater PO3342 revision AO or greater (see note 11)
Compatible PROFIBUS-DP head	PO5063V1 revision AE or greater PO5063V5 revision AF or greater GSD file version 1.22 or greater (see note 11)

Note 1 – Nominal Current per Point: The nominal current is 1,25 A per point up to the maximum ambient temperature of 40 °C. For temperatures up to 60 °C the nominal current is 1 A. When outputs are used as redundant, nominal current is 1 A per point up to maximum ambient temperature of 60 °C.

Note 2 – Maximum Total Current per Module: All outputs may be used simultaneously with nominal current. Maximum total current is 10 A for maximum ambient temperature up to 40 °C. The limit is 8 A for higher temperatures up to 60 °C. When outputs are used as redundant maximum total current is 8 A up to the maximum ambient temperature of 60 °C.

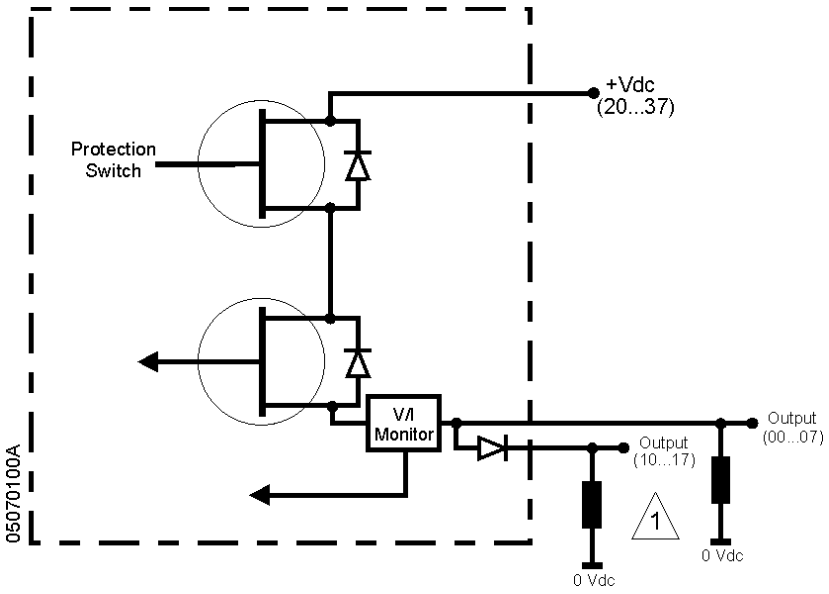
Note 3 – Maximum Current Limit: Above maximum current limit the over current protection is activated. This protection turns off the output with over current to avoid damage to the module. Continuous operation with currents between the nominal and the limit is not recommended. The use in such condition may cause permanent damage.

Note 4 – Minimum Current Limit: Currents below this level are considered as open load condition.

Note 5 – Output Groups: Each group has one common protection switch. This protection switch is turned off in the case that a failure in one point switch does not allow it to be turned off taking the entire group to the safe off state. This functionality may be disabled.

Note 6 – Current Consumption from 24Vdc Field Power Supply: To determine module's total current consumption from external power supply the loads current must be summed up with the internal circuit consumption.

Note 7 – Output Type: PO2025 has source type outputs with MOSFET transistors. It has protection diode for inductive loads. Each group of 4 outputs has a protection switch. In the case of fail keeping an output active the protection switch is opened. Each output is connected to two terminals, one directly and another through a diode. Outputs with diodes should be used in configurations with parallel outputs, as shown in **System Configurations**. Simplified diagram follows.



Observation: The output with and without diodes may not be used simultaneously.

Note 8 – Output state switching time: This time does not include the data transmission time through Ponto Series Bus. To calculate the transmission time one should consider that PO2025 refresh data each two complete bus scan (see PO5063V1 head manual – MU209508 for more details). When using in a PROFIBUS remote I/O system the value also does not include the bus data transmission times.

Note 9 – Configurable Parameters: PO2025 module is configured using configuration bytes (see section

Parameterization).

Note 10 – Redundancy: See in section **System Configurations** possible redundant topologies.

Note 11 – Compatibility: The use of PO2025 module with an incompatible CPU or fieldbus head may cause wrong behavior or became not functional.

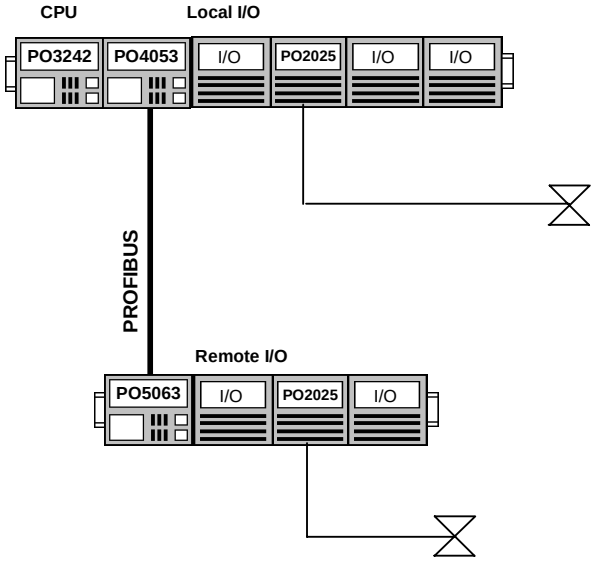
System Configurations

Suggested configurations using PO2025 are shown in the following items.

Configuration A – Local or Remote Output

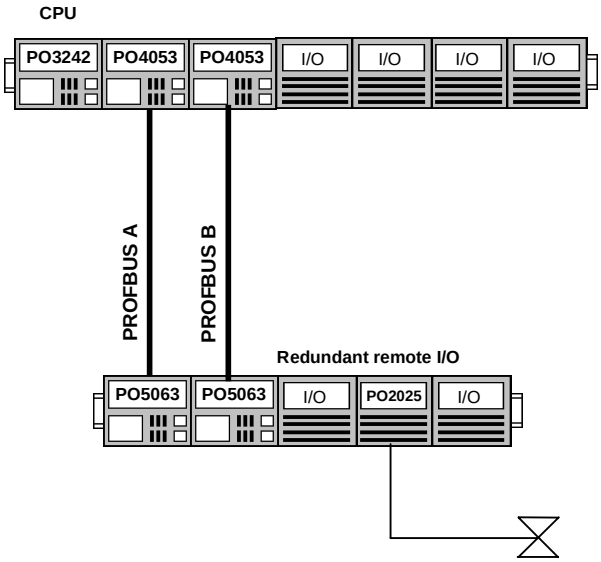
PO2025 module may be used as local or remote output.

As a remote output the module may be used with any PROFIBUS master.



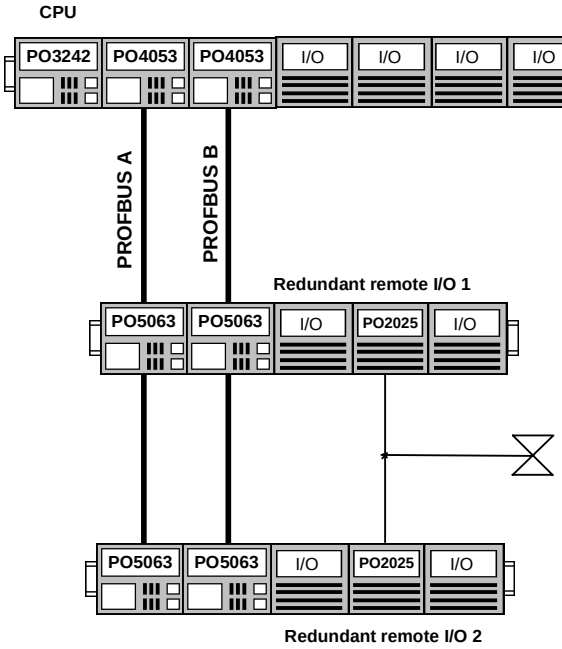
Configuration B – Output in Redundant Remote I/O System

The following configuration shows a redundant fieldbus to guarantee the behavior of safety outputs. The picture shows a Ponto Series PROFIBUS master, but other redundant masters from Altus series may be used.



Configuration C – Parallel Redundant Outputs

In configuration C it is shown how to use two outputs in parallel to guarantee system availability in a 1oo2D (1 out of 2) configuration. Used outputs may be from the same remote system or from a separate to increase safety. In those cases of parallel connection the outputs with internal diodes should be used.



Configuration shown is the one that has the higher availability with two different output modules driving the same load and located in separate redundant remote systems.

The two parallel points may be located in the same remote system, not needed to be redundant. It is also possible that the two parallel points are from the same PO2025 module. But in this case it is recommended, at least, that the two used outputs are not part from the same group.

> ATTENTION:
>
> When using outputs in parallel the current is distributed between the two modules. Using this configuration with loads near to the minimum current limit may cause open load indication.

Installation

ATTENTION:

ESD (Electro Static Discharge) sensitive device. Always touch a grounded metallic object before handling the device.

Electrical Installation with PO6002 Base

PO2025 module is compatible with digital base PO6002 with common line.

Power Supply to Module

PO2025 module must be powered with a power supply that works within module's working voltage limits. The power supply should be connected to terminals 20 to 37 and point A (+ Vcc) and to the point B (0 Vcc). Points 20 to 37 are internally connected in the terminal base. Field devices use this power supply, so it must stand the load.

It is recommended to use regulated power supplies and noise suppressors near the actuator such as valves, solenoids and contactors. This is a general rule in the design of automation systems.

Field Devices

Field devices should be connected between the output terminal (00 to 07) and Vcc (40 to 47). Points 40 to 57 are connected to B point internally in the base.

When redundancy is needed with two points in parallel driving the same load, outputs with diodes should be used. The module has those diodes internally. In those cases, field devices should be connected between the diode output terminal (10 to 17) and 0 Vcc (50 to 57).

The output in the terminals with and without diode is the same, always with the same logical level. The option to use or not the redundancy is independent in each point.

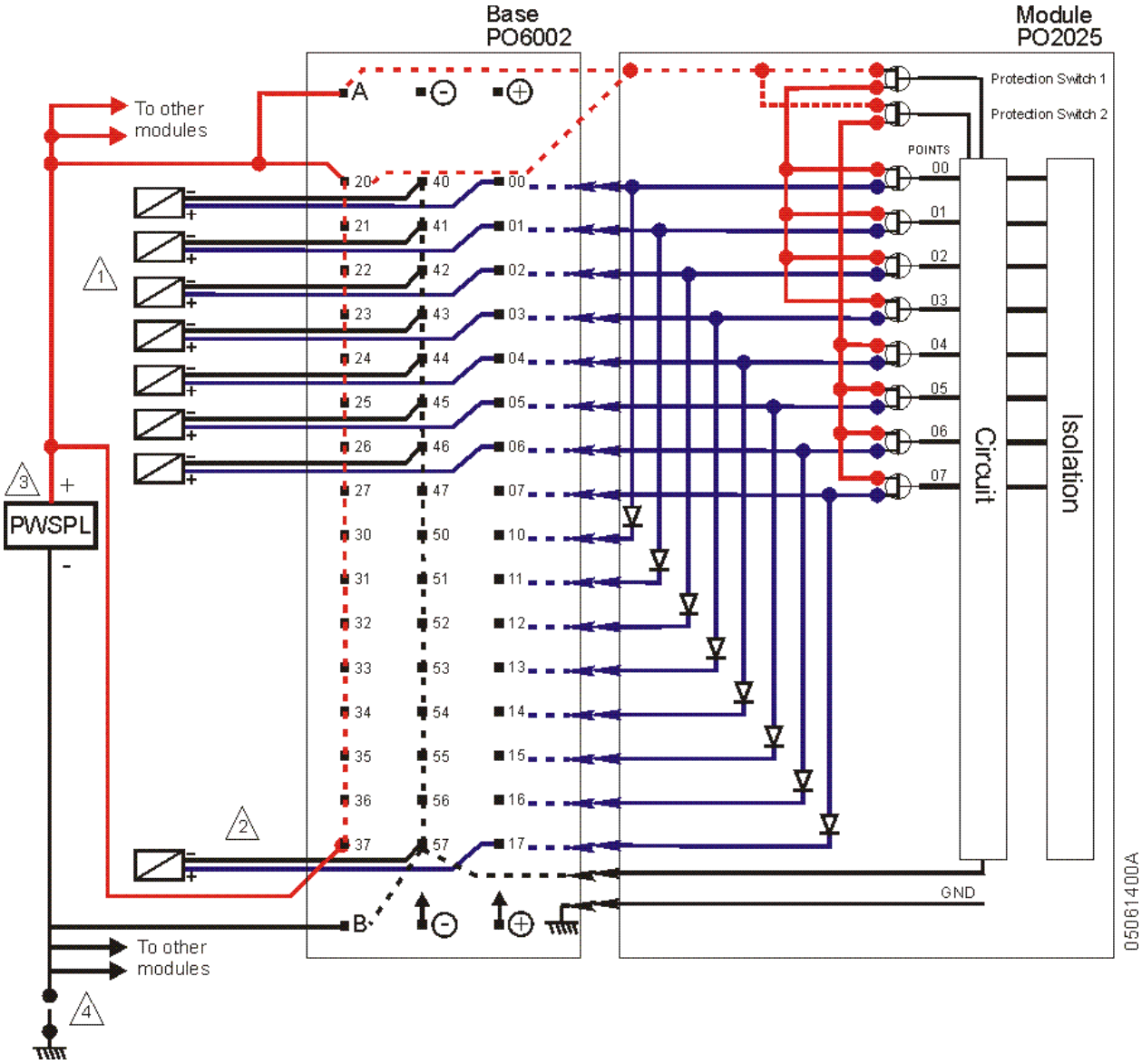


Diagram notes:

1 – Loads should have all necessary protection devices to ensure reliability. Mainly diodes to protect inductive loads with DC supply.

2 – When using redundant outputs use terminals with diodes (10 to 17).

3 – Power supply to field devices should be connected to terminals 20 to 37, A and B in each terminal base, as shown in the diagram. Voltage should be within module's limits.

4 – Power supply common point (0 V) may be connected to panel grounding. This connection is not mandatory but recommended to reduce electrical noise in an automation system.

Protection Circuit

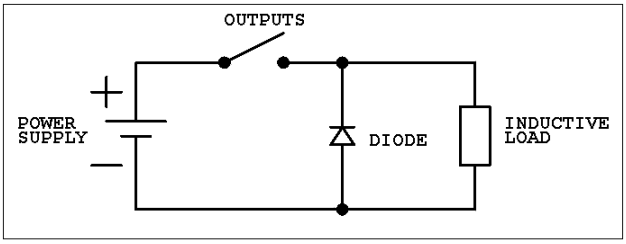
Inductive loads generate reverse voltage peaks when switched off. PO2025 module has internal protection diodes, but for a higher protection and protection of field wiring and modules connections, additional circuit must be used to limit noise current circulation to the smallest possible area in the system. Protection circuits are recommended to increase product and system wiring lifetime when working with inductive loads. Protection circuits should be assembled near the load. As a general rule it should not be more than 0,5 meter far from the load. Next a protection circuit with diode is shown.

Circuit with Diode

This is the most effective way to protect the circuit against a transient voltage in the switching of inductive loads. But this circuit also increases the switching off time if the load is, for example, a contactor or solenoid.

The circuit may only be used in continuous current systems. The reverse voltage must be greater than the power supply voltage and the current, at least, equal to the load current.

Circuits with zener diodes are not effective with this module, since the internal diode starts conducting before the zener.



ATTENTION:

Atmospheric discharges (thunders) may cause damages to the modules although their protections.

Additional protections should be used if module's power comes from a power supply located outside the cabinet where the module is installed, because this makes it vulnerable to this kind of discharges.

If the field wiring of the output points is susceptible to this kind of discharge, surge suppressors should be used.

Operation with Inductive Loads

The "Light" test consists in turning on the outputs during a short period, when the outputs are in off state, measuring the output current and comparing this current to the Minimum current limit**,** which is specified at chapter Characteristics. If the measured current is less than the Minimum current limit, a diagnostic is generated to indicate open load (see chapter Diagnosis). The time of the pulse is configurable, as can be seen at chapter Parameterization.

If, after the configured time, the channel does not reach the Minimum current limit, the pulse ends and the diagnostic is generated. If the channel reaches the Minimum current limit before the configured time, the pulse will end before the configured time and the diagnostic is not generated.

When using inductive loads, such as relays' coils, it is known the load takes some time to reach the nominal current. This is why it is needed to verify the L/R constant and the nominal current of the coil, to ensure that the configured pulse time is enough to reach the Minimum current limit.

Definition:

Maximum load detection time (t_{DETECT}) means the maximum needed time to the system reach the Minimum current limit, and is function of the resistance and inductance of the load connected to the module's output, as well as the voltage used to supply the module's outputs.

The table below shows the Maximum load detection time (t_{DETECT}), in milliseconds, when using a relay's coil as load, for different values of the coil's L/R constant and nominal current. The table shows this time for a range of values of the coil's L/R constant and nominal current. If needed, the equation described at Alternative Method of Choosing the Relay can be used to calculate this time for different values of relay parameters, not showed in the table.

L/R Constant Ranges	Nominal Current Ranges						
	0.050 to 0.099 A	0.100 to 0.249 A	0.250 to 0.499 A	0.500 to 0.749 A	0.750 to 0.999 A	1.000 to 1.249 A	1.250 to 1.500 A
10 to 99 us	0.291 ms	0.064 ms	0.021 ms	0.010 ms	0.006 ms	0.005 ms	0.004 ms
100 to 249 us	0.733 ms	0.160 ms	0.052 ms	0.025 ms	0.016 ms	0.012 ms	0.010 ms
250 to 499 us	1.469 ms	0.320 ms	0.105 ms	0.050 ms	0.033 ms	0.024 ms	0.019 ms
500 to 749 us	2.205 ms	0.481 ms	0.157 ms	0.075 ms	0.049 ms	0.036 ms	0.029 ms
750 to 999 us	2.941 ms	0.641 ms	0.210 ms	0.099 ms	0.065 ms	0.048 ms	0.039 ms
1.00 to 2.49 ms	7.332 ms	1.598 ms	0.523 ms	0.248 ms	0.162 ms	0.121 ms	0.096 ms
2.50 to 4.99 ms	14.693 ms	3.203 ms	1.048 ms	0.497 ms	0.326 ms	0.242 ms	0.193 ms
5.00 to 10.00 ms	NA[4]	6.419 ms	2.101 ms	0.995 ms	0.652 ms	0.485 ms	0.386 ms

Notes:

1 – Nominal current is the nominal current of the relay's coil used.

2 – This table considers the minimum operation voltage of the module, specified at chapter Characteristics.

3 – The calculation considers a coil with a nominal voltage of 24 Vdc.

4 – NA = not applicable. For these values of current and L/R constant, the Maximum load detection time is longer than the maximum configurable value of pulse duration.

Choosing a Relay

To choose a relay, it is needed to keep in mind three parameters of the relay: the L/R constant, the coil's nominal current and the minimum contact's operation time. With three parameters in mind, it's possible to find out the Maximum load detection time consulting the table above. This time must be shorter than the minimum contact's operation time specified at the relay's documentation, and it must be shorter than the configured "Light" pulse duration.

ATTENTION:

If the maximum load detection time (t_{DETECT}) is longer than, or very close to, the minimum operation time specified by the relay's documentation, then the relay can be incorrectly activated during a "Light" pulse.

It is strongly recommended to choose a relay with a minimum operation time extensively longer than the Maximum load detection time.

Choosing the "Light" Pulse Duration Time

The "Light" pulse duration must be configured to be longer than the Maximum load detection time, got from the table above or through the equation described at Alternative Method of Choosing the Relay, and less than the minimum operation time described at the relay's documentation.

ATTENTION:

If the configured "Light" pulse duration is shorter than the Maximum load detection time, the diagnostic "open load" may be inadvertently generated.

To ensure the correct operation of the system, the following condition must be respected:

$$t_{DETECT} < t_{LIGHT} \ll t_{RELAY}$$

Where t_{RELAY} is minimum operation time of the relay.

Alternative Method of Choosing the Relay

The Maximum load detection time can be calculated using the following equation:

$$t_{DETECT} = -\frac{L}{R} \cdot ln\left(1 - \frac{I_{LIMIT}}{I_{NOMINAL} \cdot \left(\frac{V_{OP}}{V_{NOMINAL}}\right)}\right)$$

Where, t_{DETECT} is the Maximum load detection time, in seconds, L is the coil's inductance, in H, R is the coil's resistance, in Ω, I_{LIMIT} is the value of the Minimum current limit (defined at chapter Characteristics), in Ampères, $I_{NOMINAL}$ is the nominal current of the coil, in Ampères, V_{OP} is power supply's voltage used to supply the module's outputs, in Volts, and $V_{NOMINAL}$ is the coil's nominal voltage, in Volts.

Exemple:
Relay's characteristics: L/R constant = 0.01 s, coil's nominal voltage = 24 Vdc, coil's nominal current = 125 mA and minimum operation time of 20 ms.
Power supply (minimum voltage) = 19 Vdc (if the relay tolerates this voltage)
Minimum current limit: 37.5 mA.

$$t_{DETECT} = -0.01s \cdot ln\left(1 - \frac{0.0375\ A}{0.125\ A \cdot \left(\frac{19\ V}{24\ V}\right)}\right) = 0.00476\ s = 4{,}76\ ms$$

As the Maximum load detection time was 4.76 ms, and the minimum operation time is 20 ms, this relay can be used.

ATENTTION

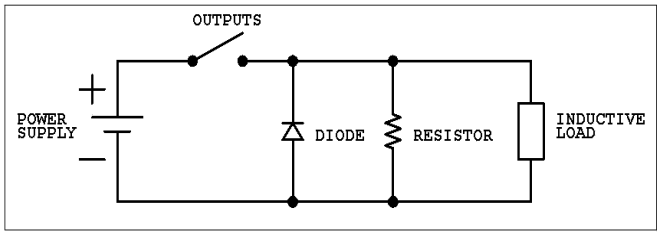
In case of doubt about the relay's characteristics, contact the relay's supplier.

Using a resistor in parallel with the load

It is possible to add a resistor in parallel with the load to reduce the Maximum load detection time.

The resistor must be calculated to drain a certain current that, when a fail at the load occurs, this fail is detected.

In other words, this current, defined as I_{LIMIT_MODULE}, must be lower than the Minimum current limit, otherwise, if the load is opened but the resistor is draining more than the Minimum current limit, the diagnostic will not be generated.



Example: if the module defines a Minimum current limit as 30 mA (± 25%), so the minimum possible value for this parameter is 22.5 mA. So, in this example, the resistor must drain less than 22.5 mA. If the voltage is 24 Vdc, it could be used one 1300 Ω resistor.

In this case the calculation of Maximum load detection time must consider the equation below to get the value of I_{LIMIT}, in Ampères, that should be used in the t_{DETECT} equation.

In the equation below, V_{OP} is the voltage used to supply the module's output, I_{LIMIT_MODULE} is the highest value of Minimum current limit possible, in Ampères, $R_{RESISTOR}$ is the resistance of the resistor, in Ω.

$$I_{LIMIT} = I_{LIMIT\_MODULE} - \frac{V_{OP}}{R_{RESISTOR}}$$

Mechanical Assembly

The mechanical assembly is described in the Ponto Series Utilization Manual. There is no particularity in the installation of this module.

Mechanical code on the terminal base is 2 on switch A and 5 on switch B.

Utilization

The use of PO2025 module is done by 2 %SXXX type operands.

Byte 0 – %SXXX								**Description**
7	**6**	**5**	**4**	**3**	**2**	**1**	**0**	
p	**p**	**p**	**p**	**p**	**p**	**p**	**p**	Value of corresponding output point
Byte 1 – %SXXX+1								**Description**
7	**6**	**5**	**4**	**3**	**2**	**1**	**0**	
r	**r**	**r**	**r**	**r**	**r**	**r**	**r**	Fail and diagnosis reset of corresponding point (rising edge)

Fail and diagnosis may only be reset 1 second after the generating event. If the rising edge in the second byte happens before this period, reset will not have immediate effect. It will occur when the event completes 1 second.

Parameterization

PO2025 module parameterization is done by software through the CPU or fieldbus head. When using an Altus CPU the parameterization is done by MasterTool Programming software. When using in a remote I/O system parameterization should be done using fieldbus master configuration tool. For more details, see manuals listed in section Manuals.

The module may be used in Safe Mode, when all protections are active or Normal Mode when only some protections are used. It is possible to individually select each protection when in Normal Mode.

Usually parameterization is done using user-friendly menus. Binary codes are listed as reference.

Parameters Bytes

Module's parameterization is defined in **eight** bytes. The two first define general module parameters. The other six define tests behavior.

Byte	Parameters
0	General
1	General
2	Enabled Outputs
3	Open Load Test
4	Enable "Light" Test
5	"Light" duration
6	Enable "Dark" Test
7	"Dark" duration

Detailed description of each byte is shown following.

Byte 0 – General								Description
7	6	5	4	3	2	1	0	
				1	**0**	**0**	**0**	Number of parameters bytes
0	**0**	**0**	**0**					Not used

This byte always has the 08 hexadecimal (08H) value, with no option.

Byte 1 – General								Description
7	6	5	4	3	2	1	0	
							0	Normal Mode
							1	Safe Mode
						0		Disable "light" test
						1		Enable "light" test
					0			Disable "dark" test
					1			Enable "dark" test
				0				Disable general inhibit
				1				Enable general inhibit
			0					Disable open load test
			1					Enable open load test
0	**0**	**0**						Not used (always zero)

Normal Mode: It is possible to individually enable each protection and test using bits 1 to 4.

Safe Mode: All protections and tests are automatically enabled. Protection enabling parameters defined by the other bits have no effect in this case.

"Light" Test: "Light" test generates **on** pulses in outputs that are in **off** state by a maximum period defined by user. The purpose is to diagnose fails in module's output circuits and problems in the field wiring. **"Light" Duration** defines the pulse maximum duration and is specified in units of 0,1 ms. It may be set between 0,4 ms and 25,5 ms (values lower than 4 are considered as 0,4 ms). The period between two consecutive tests in one point is 32 s.

"Dark" Test: "Dark" test generates **off** pulses in outputs that are in **on** state by a maximum period defined by user. The purpose is to diagnose fails in module's output circuits and problems in the field wiring. **"Dark" Duration** defines the pulse maximum duration and is specified in units of 0,1 ms. It may be set between 0,4 ms and 25,5 ms (values lower than 4 are considered as 0,4 ms). The period between two consecutive tests in one point is 32 s.

General Inhibit: This option indicates if in case of fail in one output the protection switch of the group should be switched off, inhibiting all the group. When this option is enabled and one fail in one output does not allow it to be switched off, all

the points in the group will be switched off, taking the outputs to a safe state. When this option is disabled one point may be kept in a dangerous on state but the other points in the groups will not be affected.

Open Load Test – Minimum Current: This test verifies if a minimum current flows through the load when it is active.

Default configuration for this byte is all protections and tests enabled, working in Safe Mode.

Byte 2 – Enabled outputs								**Description**
7	**6**	**5**	**4**	**3**	**2**	**1**	**0**	
h	**h**	**h**	**h**	**h**	**h**	**h**	**h**	Set when the output is used
Byte 3 – Enable open load test								**Description**
7	**6**	**5**	**4**	**3**	**2**	**1**	**0**	
A	**A**	**A**	**A**	**A**	**A**	**A**	**A**	Enable open load test (minimum current) in indicated outputs
Byte 4 – Enable "light" test								**Description**
7	**6**	**5**	**4**	**3**	**2**	**1**	**0**	
L	**L**	**L**	**L**	**L**	**L**	**L**	**L**	Enable "light" test to each output with the bit set
Byte 5 – "Light" pulse duration								**Description**
7	**6**	**5**	**4**	**3**	**2**	**1**	**0**	
l	**l**	**l**	**l**	**l**	**l**	**l**	**l**	In steps of 0,1ms (0,4 ms to 25,5ms)
Byte 6 – Enable "dark" test								**Description**
7	**6**	**5**	**4**	**3**	**2**	**1**	**0**	
D	**D**	**D**	**D**	**D**	**D**	**D**	**D**	Enable "dark" test to each output with the bit set
Byte 7 – "Dark" pulse duration								**Description**
7	**6**	**5**	**4**	**3**	**2**	**1**	**0**	
d	**d**	**d**	**d**	**d**	**d**	**d**	**d**	In steps of 0,1ms (0,4 ms to 25,5ms)

Notes:

Enabled Outputs: Enable each output point that is used. If there are unused points they should be disabled to avoid diagnosis generation. Disabled points are not powered whatever is written in correspondent output byte.

Open Load Test: Each bit enables minimum current indication in correspondent output point. Diagnosis is generated when point current is lower than the Minimum Current Limit (30 mA). This test has a general enable bit (bit 5 of parameter byte 1).

Enable "Light" Test: Each bit enables the test in correspondent output. The maximum pulse duration (time out) is defined by the following byte. The test is generated to outputs that are in **off** state. With this test it is possible to identify open loads (if enabled), over current and short-circuit. When over current or short-circuit are identified the point is placed in **over load** state and may not be switched on. To use the point again, after fixing the problem, it is needed to set corresponding bit in Reset output byte.

If the open load diagnosis is found in the "light" test it will remain active until user resets it or the load is put in place and retested.

"Light" pulse duration: Defines maximum "light" pulses duration that may be used without activating the load. The time is defined in units of 0,1 ms and minimum value is 0,4 ms. Time must be adjusted according to load characteristics. The time must be long enough to allow current flow through the load. The more inductive is the load longer should be the time.

Enable "Dark" Test: Each bit enables the test in correspondent output. The maximum pulse duration (time out) is defined by the following byte. The test is generated to outputs that are in **on** state and generates a diagnose that may not be reset. Fail diagnose is generated when the output switch is unable to switch off the point. If one output with fail in the "dark" test is turned off by the application and General Inhibit is enabled the group will be switched off going to a safe fail state.

"Dark" pulse duration: Defines maximum "dark" pulses duration that may be used without deactivating the load. The time is defined in units of 0,1 ms and minimum value is 0.4 ms. Time must be adjusted according to load characteristics. The time must be long enough to allow current flow through the load. The more capacitive is the load longer should be the time.

Diagnosis

PO2025 module has diagnosis bytes to indicate internal behavior and also the status of the loads connected to it. The two first bytes indicate general information about module's status.

Diagnosis is available to bus CPU when used in a local bus as shown in the following tables.

If the module is part of a PROFIBUS remote I/O system, diagnosis information is passed to PROFIBUS master only in the case of fail conditions. In those cases, the message code, in decimal format, is sent.

Byte	Diagnosis
0	General
1	General
2	Output 0
3	Output 1
4	Output 2
5	Output 3
6	Output 4
7	Output 5
8	Output 6
9	Output 7

Byte 0 - General								PROFIBUS Message Code	Description *PROFIBUS Message*
7	6	5	4	3	2	1	0		
						0		-	Normal
						1		09	Module with problem *Error*
				0				-	Normal
				1				31	Module has not received parameters *Module without parameters*
	0							-	Normal 24 Vdc power supply input
	1							02	Problem in 24 Vdc power supply *Undervoltage*
0		**0**	**0**		**0**		**0**	-	Always zeros

Module with problem: This bit indicates the module is defective and must be replaced.

Module without parameters: This bit is set if the module has not received parameters from bus master. In this case no output is enabled.

Problem in 24 Vdc power supply: This bit is set if external power supply is under the minimum voltage (< 19 Vdc).

Byte 1 - General								PROFIBUS Message Code	Description *PROFIBUS Message*
7	6	5	4	3	2	1	0		
							0	-	Protection switch of output group 0-3 is working normally
							1	24	Indicates voltage sensor fail in protection switch of output group 0-3. Module must be replaced *Fail general voltage input 0-3*
						0		-	Protection switch of output group 0-3 is active
						1		25	Fail in output group 0-3 cause a group power off. Module must be replaced *Fail in group 0-3*
					0			-	Protection switch of output group 4-7 is working normally
					1			26	Indicates voltage sensor fail in protection switch of output group 4-7. Module must be replaced *Fail general voltage input 4-7*
				0				-	Protection switch of output group 4-7 is active
				1				27	Fail in output group 4-7 cause a group power off. Module must be replaced *Fail in group 4-7*
0	**0**	**0**	**0**					-	Always zeros

Bytes 2 to 9 define individually the diagnosis for each output point:

Bytes 2 to 9 – Output Diagnosis								PROFIBUS Message Code	Description *PROFIBUS Message*
7	6	5	4	3	2	1	0		
							0	-	This output load is normally connected.
							1	16	This bit indicates open load (current lower than the Minimum Current Limit of 30 mA) in the corresponding output *Open load – no minimum current*
						0		-	This output current's is lower than the Maximum Current Limit of 1,5 A
						1		17	This bit indicates over current in the corresponding output (I >1,5 A) *Overload – maximum current*
					0			-	Normal behavior
					1			18	This bit indicates short-circuit in the corresponding output *Short circuit in the output*
				0				-	Normal behavior
				1				19	This bit indicates a fail connecting the corresponding output to 24 Vdc *Output stuck at 24 Vdc*
			0					-	Normal behavior
			1					20	This bit indicates a problem in the switch of the corresponding output. The module should be changed *Fail in output*
0	**0**	**0**						-	Always zeros

Notes:

Bit 0 – Open Load: indicates that the point has no load connected to it or the load current is lower than 30 mA. This diagnosis is only generated if the output is enabled and the open load test is also enabled (parameters byte 2, byte 4 and byte 1 bit 5). If the diagnosis was generated during a "light" test (output off) error reset should be used. If the load is connected the diagnosis is erased.

Bit 1 – Over Current: indicates that the point is with over current (current equal or greater to 1,5 A). If the diagnosis is generated the point is switched off. To reestablish normal working an error reset must be done.

Bit 2 – Short-circuit: indicates that the output has short-circuit. If the diagnosis is generated the point is switched off. To reestablish normal working error reset must be done. If the short-circuit is limited by power-supply current or series resistances the module may indicate only over current.

Bit 3 – Output Stuck at 24 Vdc: indicates that the point has voltage in its output although it is off. This diagnosis indicates there is short-circuit to 24 Vdc in the load. The diagnosis is reset if the problem is corrected or if the error reset byte is used.

Bit 4 – Fail in Output: indicates that the module has a problem in the corresponding output switch. If the fail could cause an erroneous switch on and general inhibit is enabled, protection switch acts and all points in the group are switched off. The diagnosis of module with problem (bit 2 in byte 0) is also activated. This diagnosis is not affected by error reset. This diagnosis has a delay of up to 200 ms.

Diagnosis LEDs

The diagnosis LED (DG) indicates the following situations:

DG LED	Meaning	Cause
On	Working with no problems	
Blinking 1X	Bus master is not accessing the module or internal logical fail	- Wrong module type for the bus position - Undeclared module - Use with incompatible CPU or fieldbus head. - Module with problem (bus interface)
Blinking 3X	Low external voltage	- External power supply is under 19 Vdc - Terminal base with defect - Module with problem (power input)
Blinking 4X	Fail in module or in the load	- Open field wiring - Short-circuit in the field wiring - Load with problem (short-circuit or load) - Module with problem (output circuit)
Off	No meaning (not in normal behavior)	- No power supply - LED with problem - Module with problem

"SAFE" LED indicates the situation of protections and tests. It is different from the others because it's green.

SAFE LED	Meaning	Cause
On	Working in Safe Mode	All protections are enable and no one is active
Blinking 1X	Working in Normal Mode and with protections enabled	The protections that are enabled are not active
Off	An output is with problem or all the protections are disabled	- All protections are disabled - Open Load - Output with over load or short-circuit - Fail in output switch - Fail in protection

Output LEDs indicate the outputs status and errors.

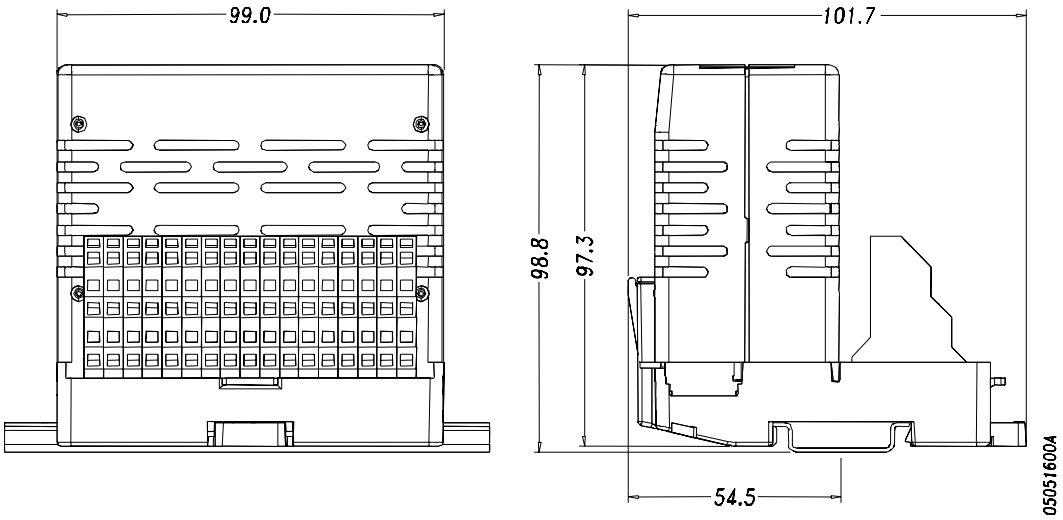
Output LEDs	Meaning	Cause
On	Output is on and working normally	
Blinking 1X	Output with problem	- Open load - Output with overload or short-circuit - Fail in output switch - Fail in protection switch
Off	Outputs are off and without errors	

Output LEDs reflect the output status. "Light" and "Dark" tests, according to their duration, may be visible in the LEDs.

Physical Dimensions

Dimensions in mm, considering the module assembled on the base.
Ponto Series Utilization Manual – MU219000 should be referenced for general panel dimensions.

The drawing shows the module PO2025 assembled on a PO6002 base and a DIN TS35 rail.



Maintenance

Hot swap procedure is described on Ponto Series Installation Manual.

Manuals

For further technical details, configuration, installation and programming of Ponto Series products, the following documents should be consulted.

Document Code	Description
CE109000	Ponto Series Characteristics and Configuration
MU219000	Ponto Series Utilization Manual
MU229601	MasterTool Programming User's Manual