INTELART

Robust in Automation

IM201 V1.0

Digital Input/output Module

Technical Manual

INTELART

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

DANGER
Indicates that death or severe personal injury will result if proper precautions are not taken.

WARNING
Indicates that death or severe personal injury may result if proper precautions are not taken.

NOTICE
Indicates that property damage can result if proper precautions are not taken.

Qualified personnel

The product/system described in this documentation may be operated only by personnel qualified for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions.

Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems

Contents

1 Technical Specifications

1.1 Hardware Parameters

The following table specifies the hardware information of the module.

Table 1 Hardware parameters

Digital Inputs	Inputs count	8
	Type of digital input	Isolated transistor (both sinking and sourcing)
	Number of inputs group	2
	Group 0 distribution	COM0, DI00, DI01, DI02, DI03
	Group 1 distribution	COM1, DI04, DI05, DI06, DI07
	Type of input voltage	DC
	Rated voltage	24 V
	For signal "0"	-30 to 11 V
	For signal "1"	12 to 30 V
	Power consumption for signal "1"	72 mW
	Configurable input delay	Yes. 1, 2.5, 7, 12, 20 ms
	Input impedance	8 kΩ
	Response time from "0" to "1"	2 µs
	Response time from "1" to "0"	4 µs
	Alternate functions	Yes. Fast Counter, Quadrature Encoder
	Stop actions	Yes. Shut Down, Keep Last Value
Digital Outputs	Outputs count	8
	Type of digital output	Isolated transistor (sinking)
	Type of output voltage	DC
	Operating voltage	5 to 30 V
	Rated operating voltage	24 V
	Rated max current	0.3 A
	Delay time from "1" to "0"	1.5 µs
	Delay time from "0" to "1"	3 µs
	Stop action support	Yes. Shut Down, Keep Last Value, Output 1, Output Custom Value

	PWM output:	Yes
	• Frequency range	0.5 to 20000 Hz (duty cycle 5% ~ 95%)
	• Min pulse duration	9 µs
	Pulse train output:	Yes
	• Pulse period range	10 to 655350 µs
	• Pulse count range	1 to 65535
Dimensions	Width	30 mm
	Height	102 mm
	Depth	58 mm
Ambient Conditions	Storage temperature	-15 to 75 ˚C
	Operating temperature	0 to 55 ˚C
	Relative humidity	Max 90 %, No Condensation
Miscellaneous	Weight	Approx. 90 g
	Power LED	Yes. Green LED
	Diagnostic LED	Yes. Yellow LED

2 Configurations

2.1 Digital Inputs

All digital inputs have a configuration for the input delay. The default value of the input delay is 0ms. The input delay is applicable to eliminate the bouncing effect of a mechanical switch.
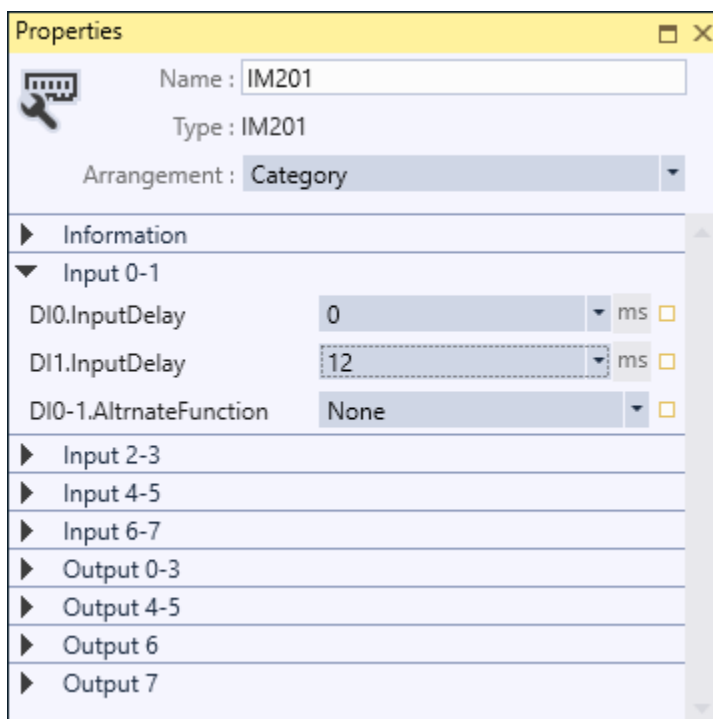

Figure 1 Properties of digital inputs

The inputs of the module can configure in order to execute another function. All digital inputs are grouped in 4 clusters. Only the group0 to group2 can be configured in order to execute an alternate function.

Table 2 Grouped digital inputs

Group 0	Group 1	Group 2	Group 3
DI00	DI02	DI04	DI06
DI01	DI03	DI05	DI07

2.1.1 Quadrature encoder

An incremental encoder with "Phase A" and "Phase B" can be sampled when a group alternate function sets as Quadrature Encoder.

2.1.2 Fast Counter

The first terminal of a group can be used as a fast counter when a group alternate function sets as Fast Counter.

2.2 Digital Outputs

The outputs of the module can configure in order to execute another function.

2.2.1 Pulse width modulation (PWM)

The output channels are grouped in 4 clusters. Each group has its own PWM frequency setting in the properties window of the module. All groups PWM frequency vary from 0.5Hz to 20000Hz.

Table 3 PWM Grouped digital outputs

Group 0	Group 1	Group 2	Group 3
DQ00	DQ04	DQ06	DQ07
DQ01	DQ05		
DQ02			
DQ03			

When any alternate function of a group sets as PWM, a new property will be appeared in order to set the PWM frequency of that group.
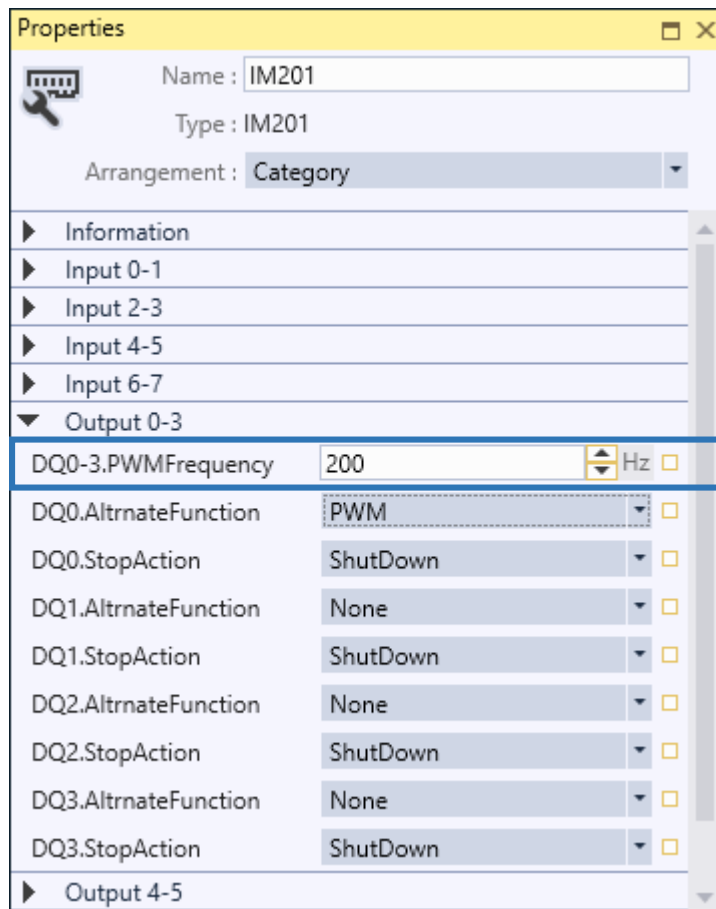
Figure 2 PWM frequency setting

The pulse waveform is slightly wider than the ideal pulse waveform for a resistive load. The following figure shows the ideal PWM signal versus the actual signal waveform. The ideal signal is specified by the blue line and the actual waveform is figured by the dashed line. The duty cycle can vary from 0% to 100%. The minimum pulse duration is 100μs. For example, if you set the frequency of output PWM to 1000Hz (a period of 1000μs) and a duty cycle of 5%, this results a pulse duration of 50μs but the actual pulse duration will be 100μs.
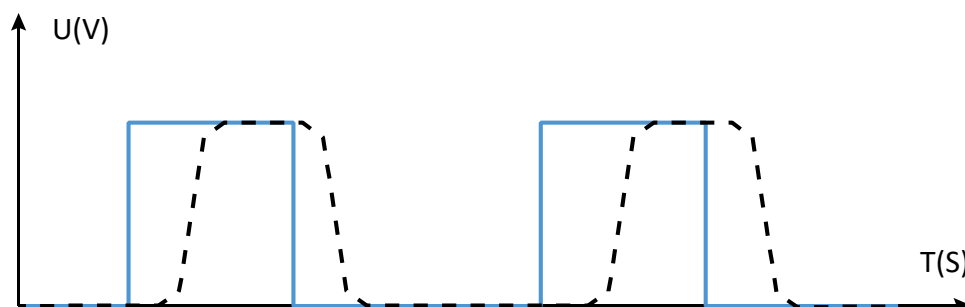

Figure 3 Actual PWM waveform of a resistive load

2.2.2 Pulse train

The pulse train function generates a configurable PWM signal with duty cycle of 50% and specified pulse count. The period of the PWM signal is a factor of 200µs.

2.2.3 Frequency out

The Frequency out function behaves same as the pulse train function but the pulse count is limitless. This function is suitable for speed control subjects.

2.2.4 Stop action

Each output channel has a property named "StopAction" which determines the act of channel when PLC state changes to stop mode. Some options will be unreachable depending on the selected alternate function of the channel.

Table 4 Available stop actions

Alternate Function	Available Stop Actions
None	ShutDown, KeepLastValue, Output 1
Pulse Train	
Frequency out	ShutDown
PWM	ShutDown, KeepLastValue, OutputCustomValue

3 Address Space

The value of input channels and output channels and some configurations will be accessible via an address space. There are bunch of predefined mapped tags in order to read or write a value in the address space. The following table illustrates the type and purpose of each mapped tag.

Table 5 Mapped tags of parameters in the address space

Category	Name	Data Type	Address	Function
Input Space (I)				
Digital Inputs	DI00 ⋮ DI07	BOOL	%I0.0 ⋮ %I0.7	Gets the value of channel when its alternative function is set to "None"
	DI00_07	BYTE	%IB0	A wrapper to get all digital input channel values as a byte
Pulse Train	PulseReadyI06 ⋮ PulseReadyI07	BOOL	%I68.6 ⋮ %I68.7	Indicates accomplishment of pulse generating when the alternate function is set to "PulseTrain"
Alternate Function	FastRegI00	UDINT	%ID4	Gets the group0 alt. function value
	FastRegI01	UDINT	%ID20	Gets the group1 alt. function value
	FastRegI02	UDINT	%ID36	Gets the group2 alt. function value
Diagnose	DiagInfo	WORD	%IW72	Gets all diagnostic information when the module is in RUN mode. • Bit 0: DQ power missing • Bit 1- Bit15: Reserved
Output Space (Q)				
Digital Outputs	DQ00 ⋮ DQ07	BOOL	%Q0.0 ⋮ %Q0.7	Sets or gets the value of channel when its alternative function is set to "None"
	DQ00_07	BYTE	%QB0	A wrapper to set or get all digital output channel values as a byte

Pulse Train	PulseStart06	BOOL	%Q56.0	Starts the CH6 pulse generating process
	PulseStart07		%Q64.0	Starts the CH7 pulse generating process
	PulseParam06	UINT	%QW52	Sets or gets the value of pulse period. Note that the value is a factor of 10µs. Example: if you set the value to 5 then the pulse period of the output will be 5*10 µs=50 µs
	PulseParam07		%QW60	
	PulseCount06	UINT	%QW54	Sets or gets the value of pulse count.
	PulseCount07		%QW62	
Frequency Out	PulseStart06	BOOL	%Q56.0	Starts the CH6 limitless pulse generating process
	PulseStart07		%Q64.0	Starts the CH7 limitless pulse generating process
	PulseParam06	UINT	%QW52	Sets or gets the value of pulse frequency. Note that the value is a factor of 1Hz. Example: if you set the value to 5000 then the pulse frequency of the output will be 5000Hz=5KHz
	PulseParam07		%QW60	Sets or gets the value of pulse frequency. Note that the value is a factor of 1Hz. Example: if you set the value to 5000 then the pulse frequency of the output will be 5000Hz=5KHz
PWM	PwmDuty00	USINT	%QB4	Sets or gets the PWM duty cycle value when the alternate function is set to "PWM"
	PwmDuty01		%QB12	
	PwmDuty02		%QB20	
	PwmDuty03		%QB28	
	PwmDuty04		%QB36	
	PwmDuty05		%QB44	
	PwmDuty06		%QB52	
	PwmDuty07		%QB60	

4 Diagnostic and Wiring

The module has 2 LEDs indicating the status of module. The following table explains the combination of these two LEDs state.

Table 6 Combination of "POWER" and "MAINT" LEDs

LED		Indicating	Solution
POWER	MAINT		
☐ Off	☐ Off	Power missing or hardware failure.	• Check the main power supply • Verify that the module is installed correctly
■ On	■ On	The module is configured and is in RUN mode.	--
■ On	☀ Flashes	Indicates an error (communication error, configuration error etc.)	• Verify that the module is installed correctly

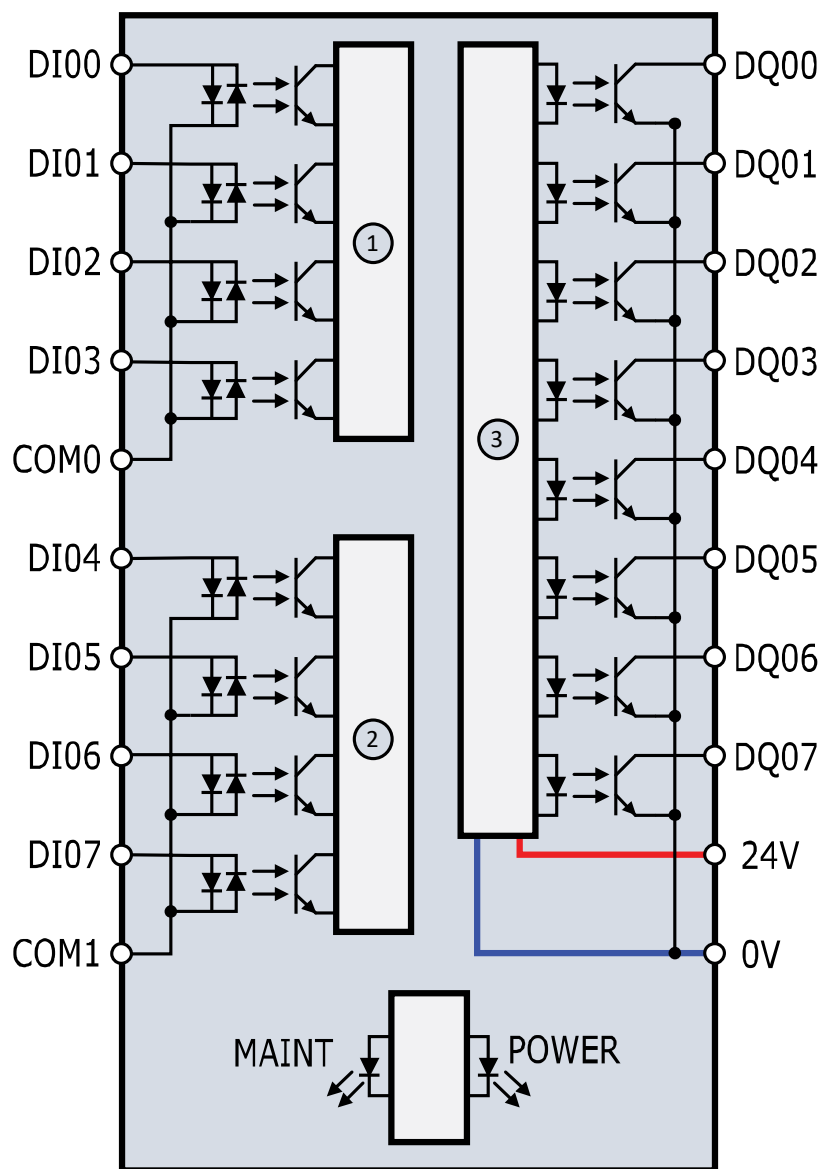The following block diagram shows you information about wiring of the module.

Figure 4 Wiring diagram and terminal assignments

①	Group0 of digital inputs	**POWER**:	Power LED
②	Group1 of digital inputs	**MAINT**:	Maintenance LED
③	Digital outputs	**DIx**:	Digital Input terminal
DQx:	Digital output terminal	**COMx**:	Common terminal of a DI group

5 Dimensional drawing

The dimensions of the module are available in this section. For install the module and its main device follow the below dimensional drawing.