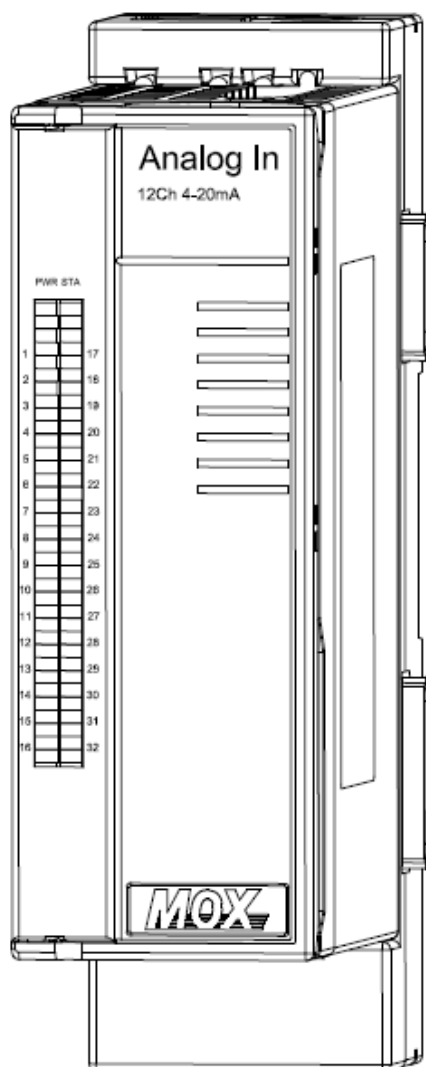


# MOX IONITY 603 Rack Base IO

## User Guide

0742-603-2301-005



## Preface

### Scope of the User Guide

This MOX IONITY 603 Rack Base IO User's Guide contains operation information for IONITY 603 Rack Base I/O modules:

Part Number	Module Description
MX603-5108-173	8 CNT Front-wiring
MX603-5112-143	12 SOE Front-wiring
MX603-5116-273	16 DI Dry Contact Front-wiring
MX603-5132-133	32 DI Dry Contact Front-wiring
MX603-5232-123	32 DO 24VDC Module Power Front-wiring
MX603-5312-113	12 AI 4-20mA Front-wiring
MX603-5312-123	12 AI 1-5VDC Front-wiring
MX603-5312-133	12 AI 4-20mA Front-wiring
MX603-5512-823	12 TC Front-wiring
MX603-5612-923	12 RTD Front-wiring
MX603-5408-123	8 AO 4-20mA Isolated Module Power Front-wiring
MX603-7020-01	General base for front wiring modules

This guide has been organized for the operator, and it is expected that the user is an engineer, technician, electrician or similar with an understanding of the operating and programming requirements of the MOX 603 I/O modules.

### Related Documents

All MOX network architectures contain a collection of MOX equipment and several software packages. For this reason, a number of related documents should be read in conjunction with this user guide.

The related documents are noted below:

- MOX IONITY System User Guide

### Conventions Used



*When you see the “exclamation mark” icon in the left-hand margin, the text to its immediate right will be a special note. Please ensure that you read this information to increase your understanding of the systems operation.*



*When you see the “stop sign” icon in the left-hand margin, the text to its immediate right will be a warning. This information could prevent injury loss of property or even death (in extreme cases). It is very important that you stop and read this information and ensure that you have complete understanding before continuing with the procedures.*

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# 1 Overview

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The MOX IONITY 603 I/O offers one of the most industry capable I/O systems available today. Designed around the current needs and future desires, it will meet almost every user's needs.

The wide range of I/O modules includes digital, analog and special purpose modules. Each module type offers comprehensive configuration options and being microprocessor based allows them to manage their own communication parameters, error conditions and user options.

A MOX IONITY 603 I/O is designed in two parts, a System Base and an I/O Module. The I/O Module may be plugged directly into the base after the base has been installed.

Physical guides on the module and the base, with module safety keying allow the module to slide into the correct position quickly and safely without damage to the module or base.

Each MOX 603 rack base I/O module provides comprehensive information to the user so that the operational status can be monitored and controlled more efficiently. The wide range of module specific diagnostic information may be accessed from a PC application package such as the MOXIDE user interface.

This manual gives a detailed description of IONITY Rack Base 603 I/O modules. All of the modules mentioned in this document are allowed to use in Zone2 (IEC) hazardous locations. Please refer to the following chapters for more information.

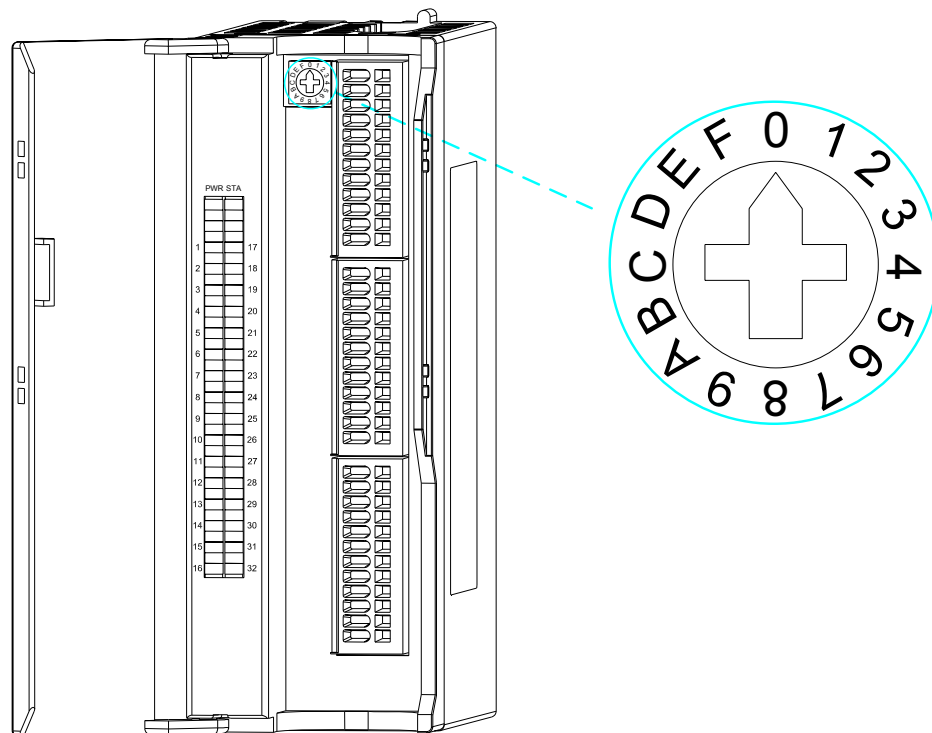
Research and development is a major focus for MOX Group resulting in new and innovative products being released continually. Please check with your local MOX Group representative to see if a desired product or feature is not listed.

## 2 General Settings

### 2.1 Station Address Assignment

The station address is the number that is used to identify each module on a rack. Each module should be assigned a unique station number within its communication rack.

For all IONITY 603 rack base I/O modules, the station address is defined by the rotary switch located on the front of the I/O module case, as shown in the following figure.



**Figure 1 Rotary Switch on the Front Wiring I/O Modules**



*The maximum number of I/O modules in one rack should conform to the specific requirements of the communication system installed. Station address 0 is reserved.*

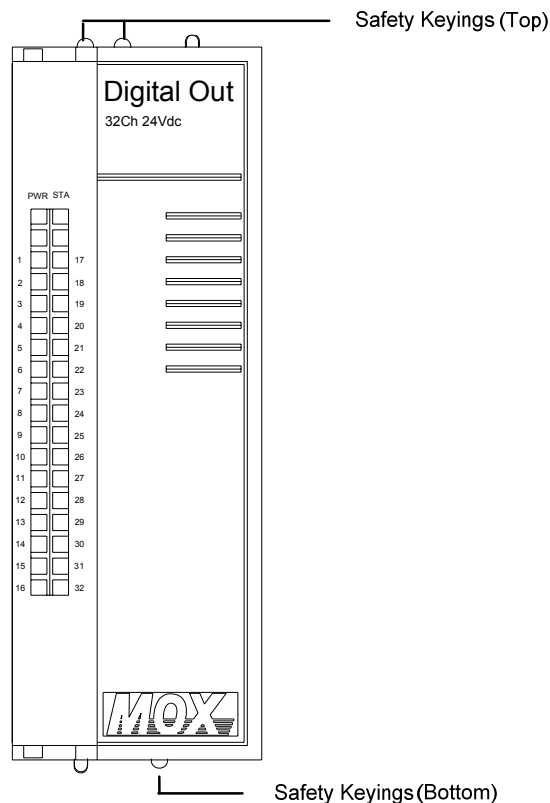
## 2.2 Safety Keying

All module and base combinations are keyed to add further protection for the installer. Module and base can only be installed when their key codes match. This removes the possibility of placing an analog module into a digitally wired base, etc.

The following figure identifies the keying code for the MOX IONITY 603 rack base I/O module. Orientate the module so that the front is facing you with the top of the module pointing up. The keys with black background in following table are permanently attached to the module.

Module Top	1	1	0	1
Module Bottom	1	0	1	0

**Table 1** Keying Code for MOX IONITY 603 Rack Base I/O Module Top and Bottom

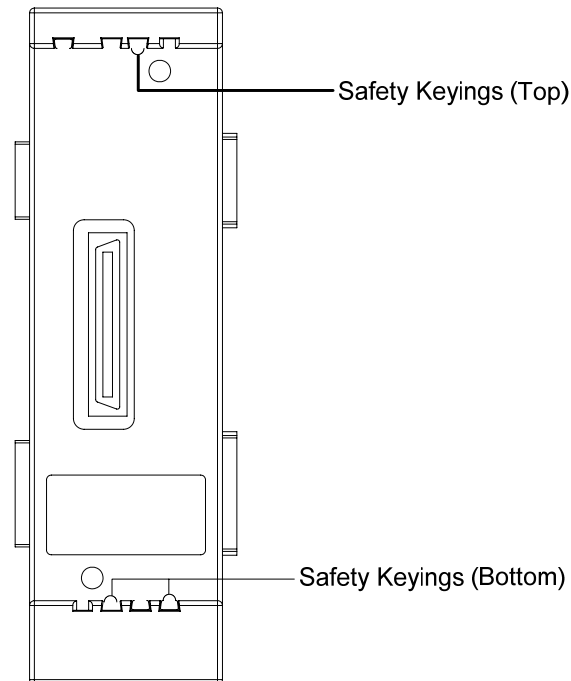


**Figure 2** Safety Keying for MOX IONITY 603 Rack Base I/O Module Top and Bottom

The following figures identify the keying code for the MOX IONITY 603 I/O base. Orientate the top side of the base to face you.

Base Top	0	0	1	0
Base Bottom	0	1	0	1

**Table 2      Keying Code for MOX IONITY 603 I/O Base Top and Bottom**



**Figure 3      Safety Keying for MOX IONITY 603 I/O Base Top and Bottom**

### 3 Rack Bases

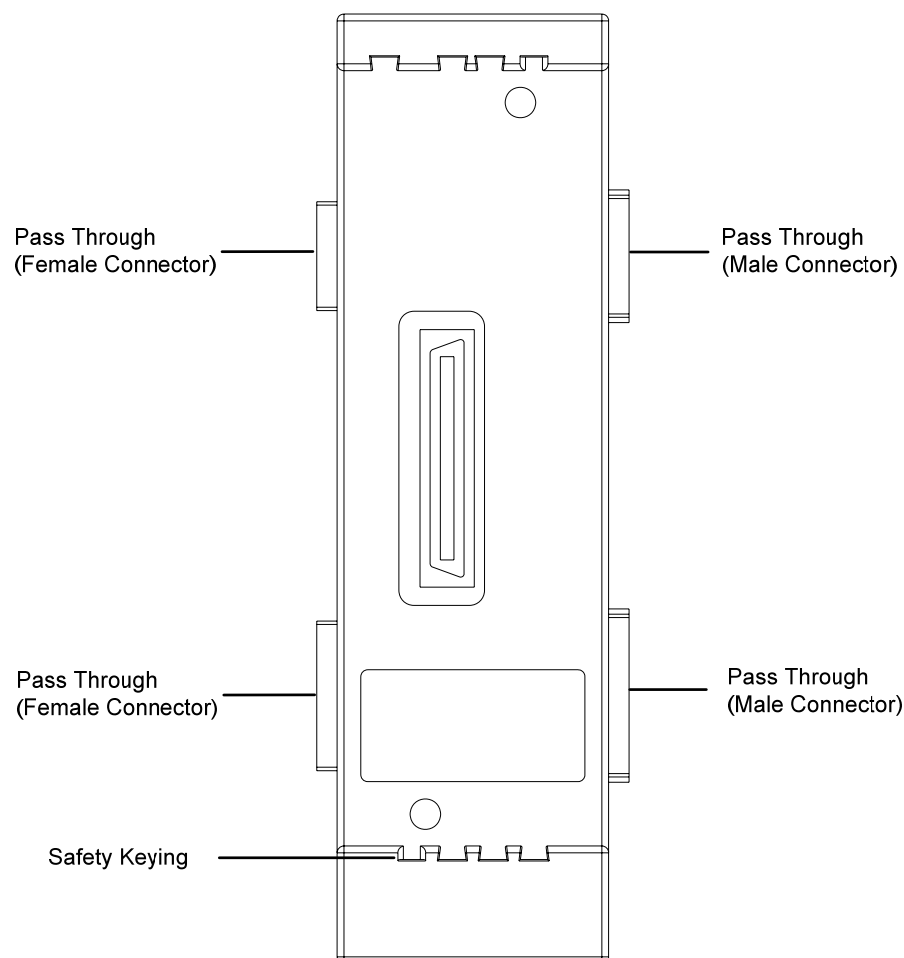
The rack base is designed to provide cascading connection for multiple MOX 603 I/O modules. The rack bases have female connectors on the left side and male connectors on the right side.

The rack bases can be identified by their product numbers, which include:

Rack Base	Description
MX603-7020-01	General base for front wiring modules

**Table 3      Rack Base Description**

#### 3.1 MX603-7020-01



**Figure 4      Rack Base MX603-7020-01 Familiarization**

MX603-7020-01 supports all front-wiring I/O modules.

Environmental Conditions	
Operating temperature	-20 to 55°C
Storage temperature	-40 to 85°C
Relative humidity	5 to 95%, non-condensing
Hazardous Location Specifications	
Zone 2 Compliance	IEC60079-0 and IEC60079-15 ("nA")

**Table 4      Rack Base MX603-7020-01 Datasheet**

## 4 I/O Modules

### 4.1 8 Channel Counter Front-wiring

---MX603-5108-173

The MOX 8 Channel Counter Front-wiring module provides 8 isolated channels for pulse signal inputs. The module can be used as a counter, frequency measurer or a rotation position measurer.

The module can accept 24V and 5V input signals from high speed output switching devices, quadrature encoders, pulse generators, proximity switches or similar devices.

#### 4.1.1 Familiarization

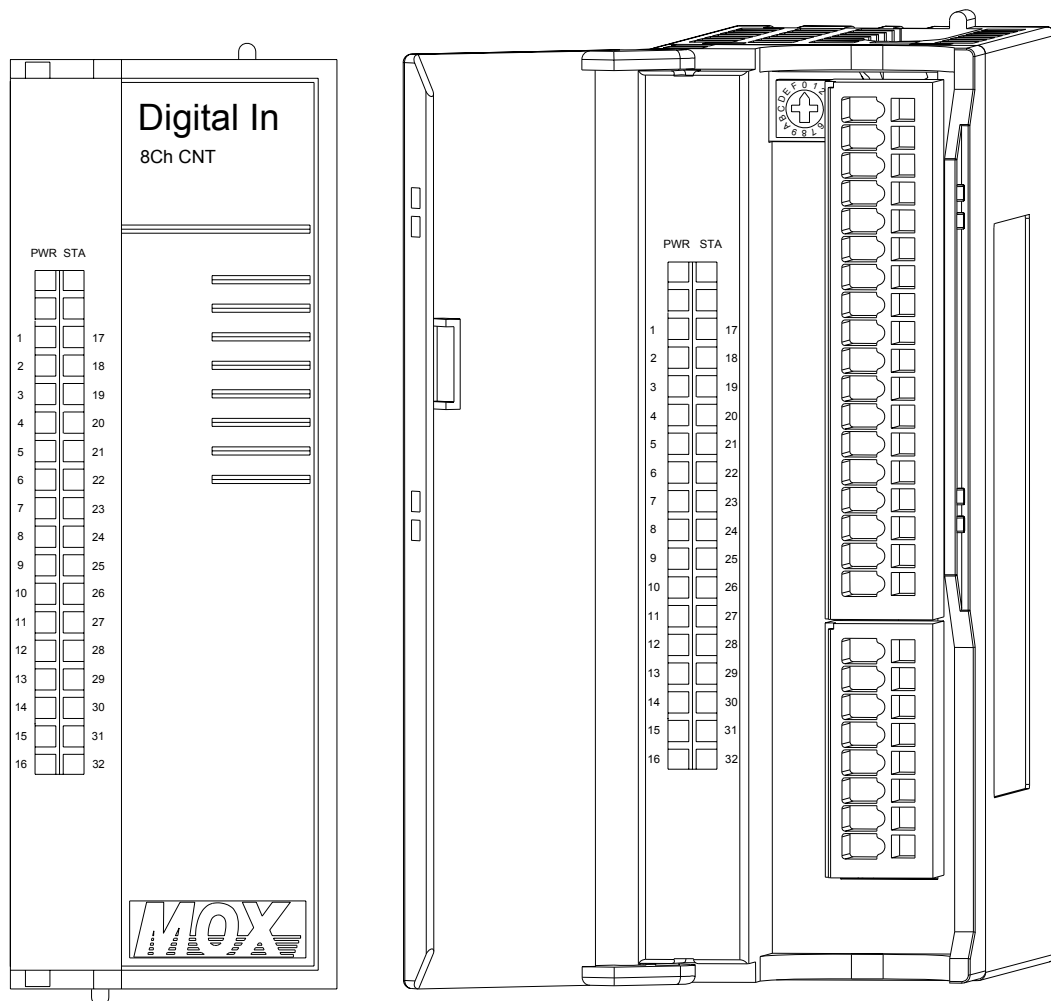


Figure 5 8 Channel Counter Familiarization

#### 4.1.2 Datasheet

<b>Input Channel Specifications</b>	
Number of channels	8
OFF voltage	24V input channel <5VDC 5V input channel <1VDC
ON voltage	24V input channel >10VDC 5V input channel >3.5VDC
Typical wetting current	24V input channel (@24VDC) 8mA 5V input channel (@5VDC) 7mA
Maximum voltage input	30VDC
Maximum input frequency	100kHz
<b>Isolation Specifications</b>	
Channel to system	1500Vrms
Channel to channel	1500Vrms
<b>Configurable Parameters</b>	
Activate channel	Activate, Deactivate
Operating mode	Continuous Counter (CC), Periodic Counter (PC), Continuous Quadrature Counter (CQC), Periodic Quadrature Counter (PQC), External Start/Stop Counter (EC), Frequency Measurement (FM)
Trigger	Rising Edge, Falling Edge
Main counting direction (CC/PC/EC)	Up, Down
Auxiliary logic (CQC/PQC)	0 to Increase 1 to Decrease, 0 to Decrease 1 to Increase
External start/stop logic (EC)	0 to Stop 1 to Start, 0 to Start 1 to Stop
Counter period unit (PC/PQC)	1000ms, 100ms, 10ms, 1ms
Counter period length (PC/PQC)	User Definable
Frequency internal gate time (FM)	1000ms, 100ms, 10ms
Frequency filter times (FM)	User Definable
Predef counter value	User Definable
<b>Environmental Conditions</b>	
Operating temperature	-20 to 55°C
Storage temperature	-40 to 85°C
Relative humidity	5 to 95%, non-condensing
<b>Power Supplies</b>	
Power dissipation within module	<3.0W
<b>Hazardous Location Specifications</b>	
Zone 2 Compliance	IEC60079-0 and IEC60079-15 ("nA")

Table 5 8 Channel Counter Datasheet



### 4.1.3 Equivalent Circuit Diagram

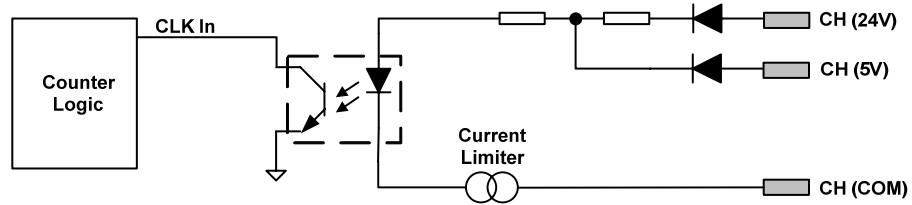


Figure 6 8 Channel Counter Equivalent Circuit Diagram

### 4.1.4 Indication LEDs

LED	Color	State	Description
PWR	Green	ON	The module is powered on
		OFF	The module is not functioning
STA	Green	ON	The onboard system is functioning
		OFF	1) Station number is 0 2) Parameters are corrupted
		Flashing at 50ms ON, 950ms OFF	Parameters do not match the type of module
1	Green	ON	Channel is ON
		OFF	Channel is OFF
2	Green	ON	Channel is ON
		OFF	Channel is OFF
.	.	.	.
.	.	.	.
.	.	.	.
8	Green	ON	Channel is ON
		OFF	Channel is OFF

Table 6 8 Channel Counter LED Definitions

#### 4.1.5 Cabling Guide



























1		CH1 (24V)			
2		CH1 (5V)			
3		CH1 (COM)			
4		CH2 (24V)			
5		CH2 (5V)			
6		CH2 (COM)			
7		CH3 (24V)			
8		CH3 (5V)			
9		CH3 (COM)			
10		CH4 (24V)			
11		CH4 (5V)			
12		CH4 (COM)			
13		CH5 (24V)			
14		CH5 (5V)			
15		CH5 (COM)			
16		CH6 (24V)			
17		CH6 (5V)			
18		CH6 (COM)			
			19		CH7 (24V)
			20		CH7 (5V)
			21		CH7 (COM)
			22		CH8 (24V)
			23		CH8 (5V)
			24		CH8 (COM)
			25		N/A
			26		N/A

Figure 7 8 Channel Counter Pin Definitions

**CH (24V):** 24V signal input  
**CH (5V):** 5V signal input  
**CH (COM):** Common negative

Note:

- 1) Each input channel can accept 24V signal or 5V signal. However, these two types of signals cannot be connected to one channel simultaneously.
- 2) 24V and 5V signal can be accepted by different input channels at the same time. For example, the input signal to channel 1 is 24V and the signal to channel 2 can be either 24V or 5V.
- 3) In some operating modes, e.g. *Continuous Quadrature Counter Mode*, *Periodic Quadrature Counter Mode*, *External Start/Stop Counter Mode*, adjacent odd and even numbered channels are used as a group in which the odd is the main input and the even is auxiliary.

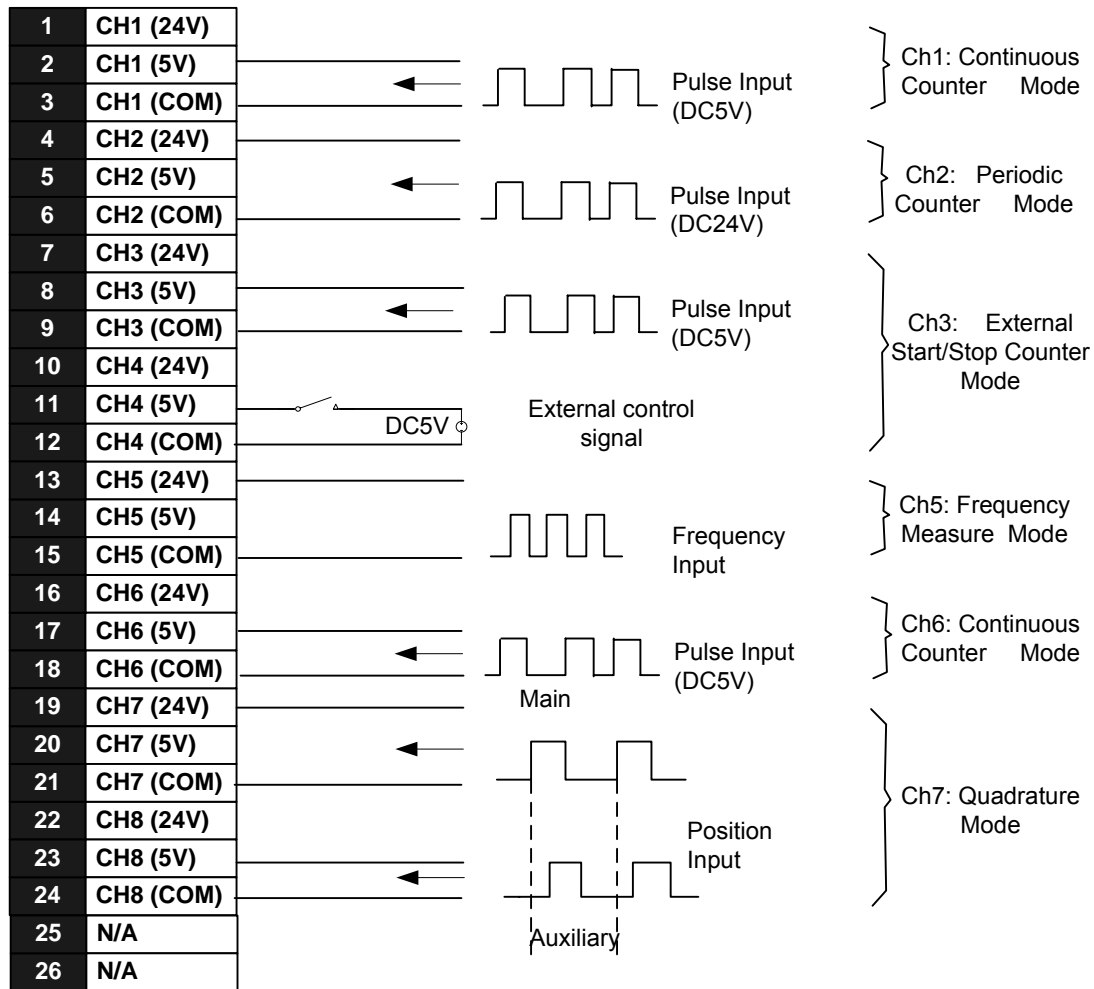


Figure 8 8 Channel Counter Cabling Diagram

#### 4.1.6 Safety Keying

Module Top	1	1	0	1
Base Top	0	0	1	0
Module Bottom	1	0	1	0
Base Bottom	0	1	0	1

Table 7 8 Channel Counter Safety Keying

#### 4.1.7 Configurable Channel Parameters

Using MOXIDE the following attributes can be configured to suit the required operation of each channel of the module.

- **Activate Channel**

The users are able to activate/deactivate any channel they desire through this parameter. Each channel has this attribute and as such its status can be manipulated by altering this parameter.

The factory default is “activated” for all channels.

- **Operating Mode**

If the Operating Mode of an odd numbered channel is configured as *Continuous Quadrature Counter Mode*, *Periodic Quadrature Counter Mode*, *External Start/Stop Counter Mode*, the configuration of its subsequent even numbered channel is omitted.

**Continuous Counter Mode (CC)**

In *continuous counter mode*, after a “Start” command the counter value is increased or decreased by 1 when a pulse is received and continues until a “Stop” command is given. The counting direction is defined by the *Main Counting Direction* parameter. The default status of the counter after reset or power on is user-started.

**Periodic Counter Mode (PC)**

In *periodic counter mode*, after a “Start” command the counter value is increased or decreased by 1 when a pulse is received and continues until a defined time span has elapsed or a “Stop” command is given. The counting direction is defined by the *Main Counting Direction* parameter. The time span ranges from 10ms to 250s with varying granularity according to the selected time unit. The default status of the counter after reset or power on is user-stopped.

**Continuous Quadrature Counter Mode (CQC)**

In *continuous quadrature counter mode*, after a “Start” command, the counter value is increased or decreased by 1 when a pulse is received and continues until a “Stop” command is given. The counting direction is dynamically changed by auxiliary input, which is defined by the *Auxiliary Logic* parameter. The default status of the counter after reset or power on is user-started.

**Periodic Quadrature Counter Mode (PQC)**

In *periodic quadrature counter mode*, after a “Start” command, the counter value is increased or decreased by 1 when a pulse is received and continues until a defined time span has elapsed or a “Stop” command is given. The counting direction is dynamically changed by auxiliary input, which is defined by the *Auxiliary Logic*. The time span ranges from 10ms to 250s. The default status of the counter after reset or power on is user-stopped.

**External Start/Stop Counter Mode (EC)**

In *External Start/Stop Counter mode*, the “Start/Stop” command is given from an external signal connected to the auxiliary input pins. At the same time, the user “Start/Stop” command is reserved and gives an “AND” effect to the external command, which means that the external command could control counting only when the counter is user started. The *External Start/Stop Logic* parameter controls the command action and the *Main Counting Direction* parameter defines the counting direction. The default status of the counter after reset or power on is user-started. When the external signal has no effect on starting or stopping the counter, ensure that the user-start command had been issued.

In this mode, the counter can only be continuous and non-quadrature.

#### **Frequency Measurement Mode (FM)**

In the *Frequency Measurement mode*, the counter keeps receiving pulses in a defined period and then calculates the pulse frequency. The *Inter Gate Time* parameter defines the period length. The *Filter Times* parameter defines the sliding window width to make one average frequency calculation. The wiring of this mode is identical to the continuous counter.

#### ▪ **Trigger**

A trigger edge parameter is always used. The counter changes when the module is powered on with the reception of a user defined trigger edge.

#### ▪ **Main Counting Direction (CC/PC/EC)**

Counting can be up or down.

In the up counting situation, if  $2^{32}-1$  is reached and another pulse is received, the counter will jump to 0 and continues counting up without missing any pulses. In the down counting situation, if 0 is reached and another pulse received, the counter will jump to  $2^{32}-1$  and continues counting down without missing any pulses.

#### ▪ **Auxiliary Logic (CQC/PQC)**

If a channel is configured as Continuous Quadrature Counter Mode or Periodic Quadrature Counter Mode, this parameter will define the auxiliary input logic of the channel.

##### **“0 to Increase, 1 to Decrease”**

After a Start command, when a pulse is received, the counter is increased by 1 if the auxiliary input is 0 or decreased by 1 if the auxiliary input is 1. This continues until a Stop command is given.

##### **“0 to Decrease, 1 to Increase”**

After a Start command, when a pulse is received, the counter is increased by 1 if the auxiliary input is 1 or decreased by 1 if the auxiliary input is 0. This continues until a Stop command is given.

The default is “0 to Increase, 1 to Decrease”.

#### ▪ **External Start / Stop Logic (EC)**

In external start/stop counter mode, the auxiliary inputs are used as counter start/stop signals when the counters are enabled by the control signals from the controller. The user defines the control logic by this parameter.

##### **“0 to Stop 1 to Start”**

After a Start command, when a pulse is received, the counter is increased by 1 or decreased by 1 if the auxiliary input is 1. This continues until a Stop command is given or the auxiliary input is 0.

##### **“0 to Start 1 to Stop”**

After a Start command, when a pulse is received, the counter is increased by 1 or decreased by 1 if the auxiliary input is 0. This continues until a Stop command is given or the auxiliary input is 1.

The default is “0 to Stop 1 to Start”.

#### ▪ **Counter Period Unit (PC/PQC)**

In Periodic Counter Mode or Periodic Quadrature Counter Mode, the Counter Period Unit parameter together with Counter Period Length parameter defines the time span in which the counting action

will continue. The granularity and precision of time span will be variant according to different time unit.

- **Counter Period Length (PC/PQC)**

An integer value ranges from 1 to 250.

If *Counter Period Unit* \* *Counter Period Length* < 10ms, 10ms will take effect.

- **Frequency Interval Gate Time (FM)**

The frequency for any input is continuously measured based on counted pulses in a selectable gate time period. This parameter can have the following options:

- 10ms
- 100ms
- 1000ms

The default value is "1000ms".

- **Frequency Filter Times (FM)**

The Filter Times parameter defines the sliding window width to make an average frequency calculation.

- **Predefined Counter Value**

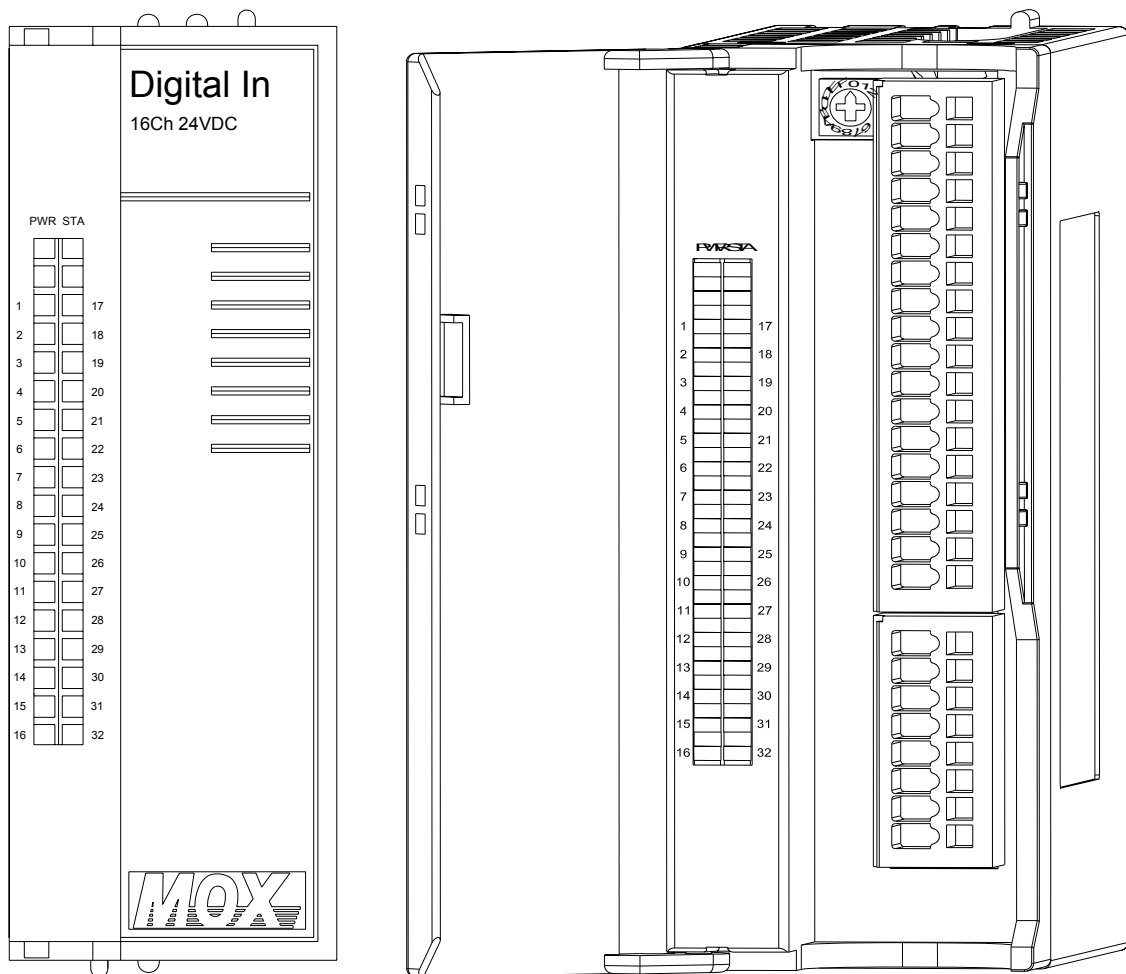
The user can enter in a predefined counter value.

## 4.2 16 Channel Digital Input Dry Contact Front-wiring

### ---MX603-5116-273

The MOX 603 16 Channel Digital Input Dry Contact Front-wiring module supports 16 isolated discrete inputs.

#### 4.2.1 Familiarization



**Figure 9 16 Channel Digital Input Dry Contact Front-wiring Familiarization**

#### 4.2.2 Datasheet

Input Specifications	
Number of channels	16
Minimum pulse width detected	6ms
Maximum switching frequency (no-filtering)	80Hz
Isolation Specifications	
Group* to group isolation	1000Vrms
Channels to system isolation	2500Vrms
Configurable Parameters	
Type of channel	Only Discrete Input, Only Enable Counter, Enable Counter and Frequency, Only Enable Latch High, Only Enable Latch Low
Filter time (ms)	User Definable
Diagnostic Information	
Wire break diagnostic	Configurable
Power fault diagnostic	Configurable
Environmental Conditions	
Operating temperature	-20 to 55°C
Storage temperature	-40 to 85°C
Relative humidity	5 to 95%, non-condensing
Hazardous Location Specifications	
Zone 2 Compliance	IEC60079-0 and IEC60079-15 ("nA")
Power Consumption	
Power Consumption	<1.0W

\*: Four channels are defined as one Group.

Table 8 16 Channel Digital Input Dry Contact Front-wiring Datasheet

#### 4.2.3 Equivalent Circuit Diagram

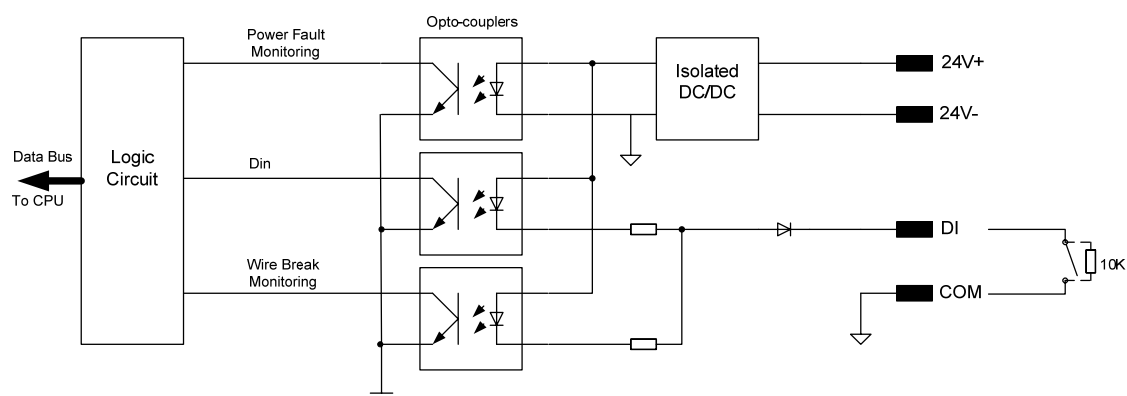


Figure 10 16 Channel Digital Input Dry Contact Front-wiring Equivalent Circuit Diagram



#### 4.2.4 Indication LEDs

LED	Color	State	Description
PWR	Green	ON	The module is powered on
		OFF	The module is not functioning
STA	Green	ON	The onboard system is functioning
		OFF	1) Station number is 0 2) Parameters are corrupted
		Flashing at 50ms ON, 950ms OFF	Parameters do not match the type of module
1	Green	ON	Channel is ON
		OFF	Channel is OFF
2	Green	ON	Channel is ON
		OFF	Channel is OFF
.	.	.	.
.	.	.	.
.	.	.	.
16	Green	ON	Channel is ON
		OFF	Channel is OFF

Table 9 16 Channel Digital Input Dry Contact Front-wiring LED Definitions

#### 4.2.5 Cabling Guide

The pins of 16 Channel Digital Input Dry Contact Front-wiring are located on the front of the module. Their definitions are shown below:

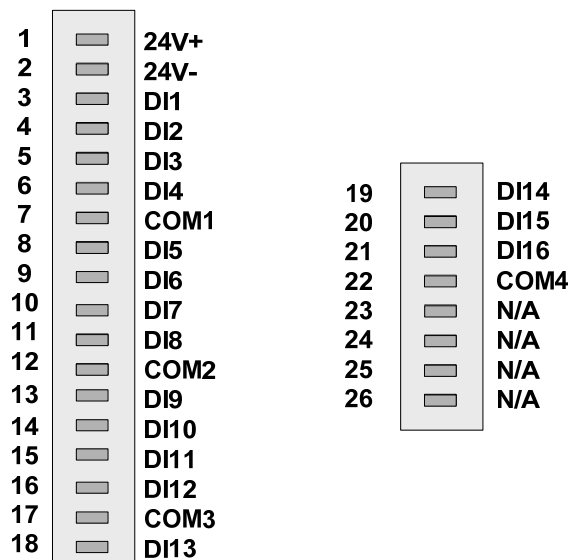
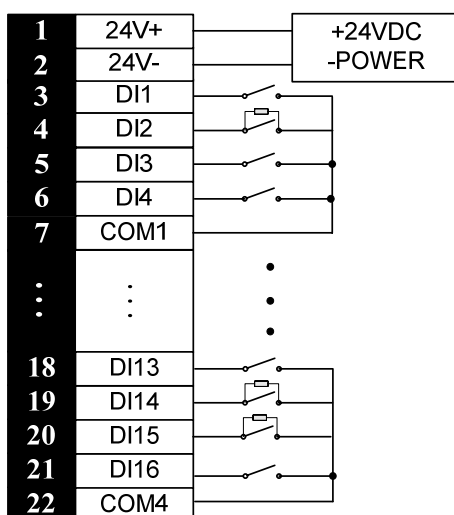


Figure 11 16 Channel Digital Input Dry Contact Front-wiring Pin Definitions



In the figure above, five channels are defined as one group. DI1~COM1 is Group1, DI5~COM2 is Group2, DI9~COM3 is Group3, DI13~COM4 is Group4.



**Figure 12** 16 Channel Digital Input Dry Contact Front-wiring Cabling Guide

Each channel can be connected to a contact with wire break monitoring or without wire break monitoring. The contact with wire break monitoring has a 10kΩ resistor paralleled with it.

The module adopts base MX603-7020-01.

#### 4.2.6 Safety Keying

Module Top	1	1	0	1
Base Top	0	0	1	0
Module Bottom	1	0	1	0
Base Bottom	0	1	0	1

**Table 10** 16 Channel Digital Input Dry Contact Front-wiring Safety Keying

#### 4.2.7 *Configurable Channel Parameters*

- **Type of Channel**

This parameter allows the user to change the input type of each channel. e.g. counter or latch.

**Only Discrete Input:** The channel only accepts a discrete input with ON or OFF indication.

**Only Enable Counter:** The channel gives a counter value.

**Enable Counter and Frequency:** The channel gives counter and frequency values.

**Only Enable Latch High:** If the channel is OFF, and unlatch register is ON, when an ON signal comes, the ON status will be latched for this channel, until both unlatch register and signal recover to OFF.

**Only Enable Latch Low:** If the channel is ON, and unlatch register is OFF, when an OFF signal comes, the OFF status will be latched for this channel, until both unlatch register and signal recover to ON.

The factory default is “Only Discrete Input” for all channels.

- **Filter Time (ms)**

The *Filter Time* is the length of time that a newly changed input to some channel should last for before it is accepted as a valid input.

It is used to eliminate input noise. If the *filter time* is zero then there is no filter on this channel. The factory default value is “0ms”.

## 4.3 12 Channel SOE Front-wiring

### ---MX603-5112-143

The MOX 603 12 Channel SOE module provides 12 isolated discrete input channels, which accept digital signal and stamps events with precise time. As one member of the MOX system, 12 SOE module maintains the sequence of the events that generate from the field, converts and transfers them to the upper controller. The module supports Extended Modbus/ModNet protocol to communicate with other devices.

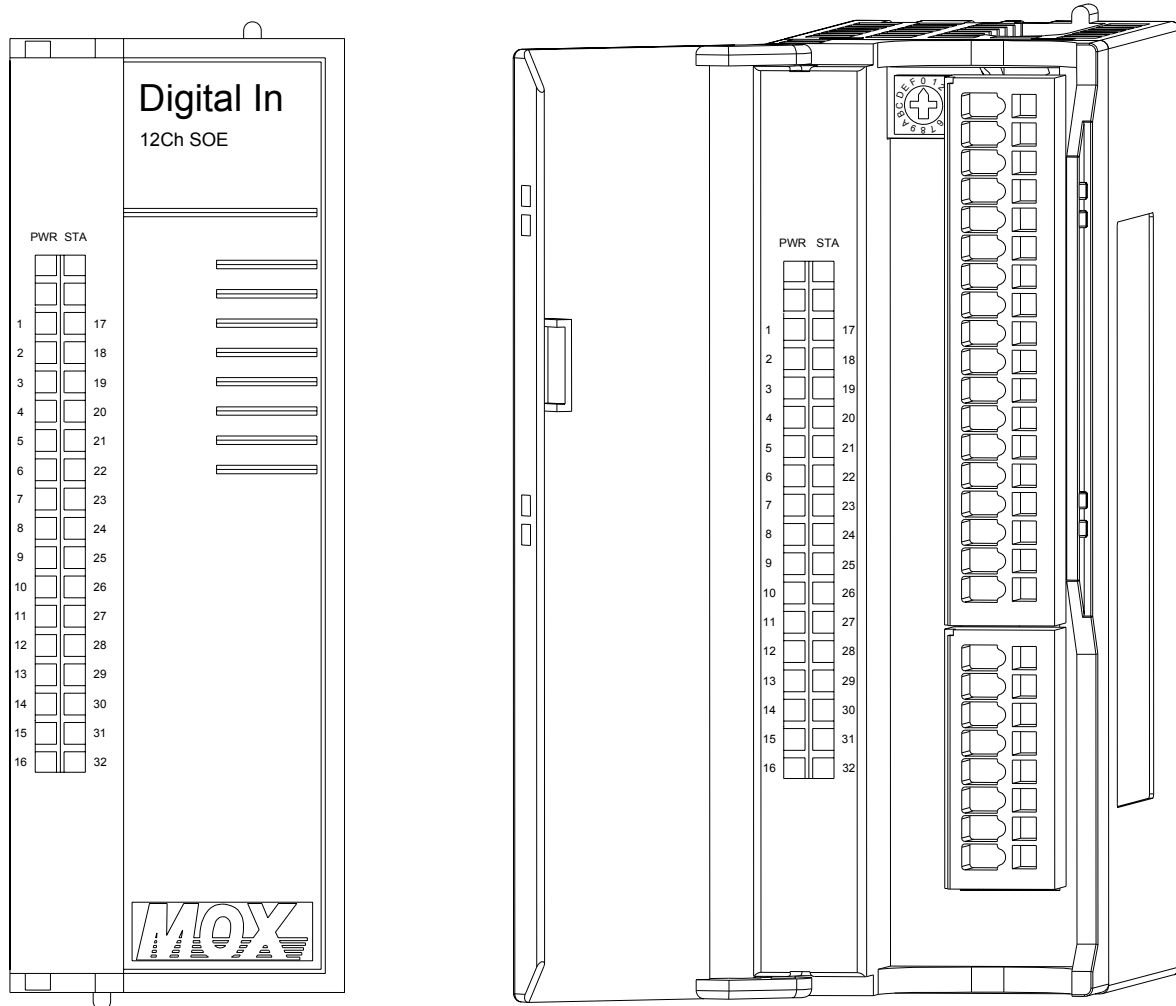
The 12 channel discrete inputs are all current sink inputs. The voltage range of the inputs are 0~30VDC. If the input voltage is lower than 5VDC, the channel is off. If the input voltage is higher than 10VDC, the channel is on. The normal sink current is 6mA at 24VDC.

The module uses a synchronization channel to acquire synchronization signal from the upper controller.

The following are some features of the module.

- Record 256 history events
- Rising edge and falling edge available
- 0.1ms resolution
- Normal DI function
- Deleting the events from the SOE buffer is executed by the upper controller
- Sufficient diagnostic information
- Channel to channel, channel to system isolation
- Inverse wiring protection
- Channels independently configurable

### 4.3.1 Familiarization



**Figure 13**      **12 Channel SOE Front-wiring Familiarization**

### 4.3.2 Datasheet

Input Specifications	
Number of channels	12
OFF voltage of the input channel	<5VDC
ON voltage of the input channel	>10VDC
Typical wetting current (@24VDC)	6mA
Maximum voltage input	30VDC
Resolution	0.1ms
Accuracy	±1ms
Maximum history events	256
Isolation Specifications	
Channel to system	3000Vrms
Channel to channel	3000Vrms
Configurable Parameters	
Activate Channel	Activate, Deactivate
Chatter Mode Count	User Definable
Filter Time (ms)	User Definable
Debounce Time (ms)	User Definable
Environmental Conditions	
Operating temperature	-20 to 55°C
Storage temperature	-40 to 85°C
Relative humidity	5 to 95%, non-condensing
Hazardous Location Specifications	
Zone 2 Compliance	IEC60079-0 and IEC60079-15 ("nA")
Power Consumption	
Power Consumption	<3.5W

Table 11 12 Channel SOE Front-wiring Datasheet

### 4.3.3 Equivalent Circuit Diagram

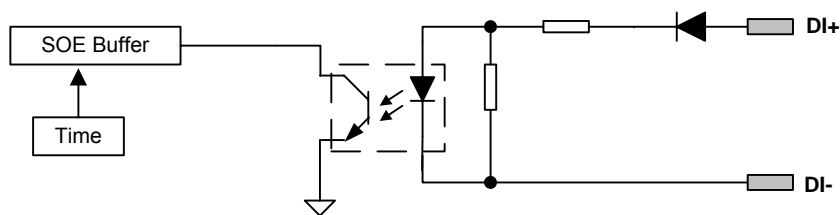


Figure 14 12 Channel SOE Front-wiring Equivalent Circuit Diagram

#### 4.3.4 Indication LEDs

LED	Color	State	Description
PWR	Green	ON	The module is powered on
		OFF	The module is not functioning
STA	Green	ON	The onboard system is functioning
		OFF	1) Station number is 0 2) Parameters are corrupted
		Flashing at 50ms ON, 950ms OFF	Parameters do not match the type of module
1	Green	ON	Channel is ON
		OFF	Channel is OFF
2	Green	ON	Channel is ON
		OFF	Channel is OFF
.	.	.	.
.	.	.	.
.	.	.	.
12	Green	ON	Channel is ON
		OFF	Channel is OFF

Table 12 12 Channel SOE Front-wiring LED Definitions

#### 4.3.5 Cabling Guide



























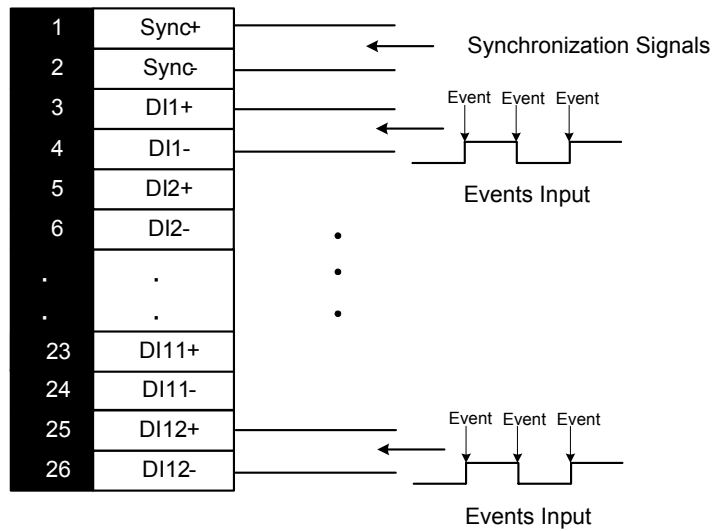
1		Sync+
2		Sync-
3		DI1+
4		DI1-
5		DI2+
6		DI2-
7		DI3+
8		DI3-
9		DI4+
10		DI4-
11		DI5+
12		DI5-
13		DI6+
14		DI6-
15		DI7+
16		DI7-
17		DI8+
18		DI8-
19		DI9+
20		DI9-
21		DI10+
22		DI10-
23		DI11+
24		DI11-
25		DI12+
26		DI12-

Table 13 12 Channel SOE Front-wiring Pin Definitions



**Figure 15** 12 Channel SOE Front-wiring Wiring Diagram

The module adopts base MX603-7020-01.

#### 4.3.6 Safety Keying

Module Top	1	1	0	1
Base Top	0	0	1	0
Module Bottom	1	0	1	0
Base Bottom	0	1	0	1

**Table 14** 12 Channel SOE Front-wiring Safety Keying

#### 4.3.7 Configurable Channel Parameters

##### ▪ Activate Channel

The users are able to activate/deactivate any channel they desire through this parameter. Each channel has this attribute and as such its status can be manipulated by altering this parameter.

The factory default is “activated” for all channels.



- **Chatter Mode Count**

If the number of produced events per minute of one channel exceeds the *chatter mode count*, this channel will be disabled from further event processing. An event will be generated to indicate this time point. When the number of events per minute drops below the *chatter mode count*, the channel will be enabled and another event will be generated to indicate this time point.

It is used to prevent erroneous events caused by a faulty input. The factory default value of the *chatter mode count* is zero, which means the chatter mode is disabled for the channel.

- **Filter Time (ms)**

The *Filter Time* is the length of time that a newly changed input to some channel should last for before it is accepted as a valid input.

It is used to eliminate input noise. If the *filter time* is zero then there is no filter on this channel. The factory default value is “3ms”.

- **Debounce Time (ms)**

The *Debounce Time* is the length of time that an incoming event processing is disabled for a channel after a new event has been produced.

It is used to prevent extra events from a single contact closure. If debounce time is zero then there is no debounce on this channel. The factory default value is “3ms”.

## 4.4 32 Channel Digital Input Dry Contact Front-wiring

### ---MX603-5132-133

The MOX 603 32 Channel Digital Input Dry Contact module supports 32 non-isolated dry contact inputs.

#### 4.4.1 Familiarization

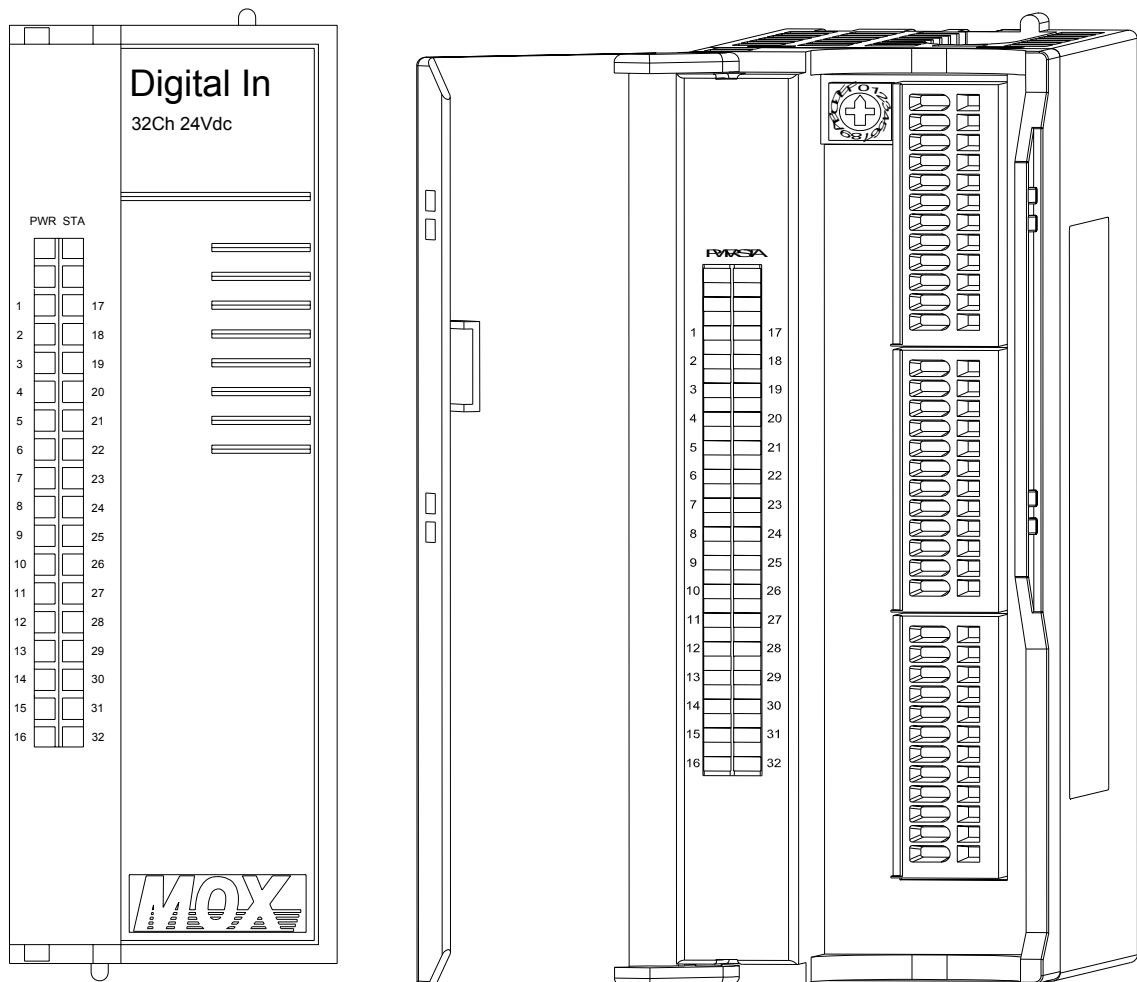


Figure 16 32 Channel Digital Input Module

#### 4.4.2 Datasheet

Input Specifications	
Number of channels	32
Minimum pulse width detected	6ms
Maximum switching frequency (no-filtering)	80Hz
Isolation Specifications	
Channel to system	1000Vrms
Configurable Parameters	
Type of channel	Only Discrete Input, Only Enable Counter, Enable Counter and Frequency, Only Enable Latch High, Only Enable Latch Low
Filter time (ms)	User Definable
Environmental Conditions	
Operating temperature	-20 to 55°C
Storage temperature	-40 to 85°C
Relative humidity	5 to 95%, non-condensing
Hazardous Location Specifications	
Zone 2 Compliance	IEC60079-0 and IEC60079-15 ("nA")
Power Consumption	
Power Consumption	<1.0W

Table 15 32 Channel Digital Input Datasheet

#### 4.4.3 Equivalent Circuit Diagram

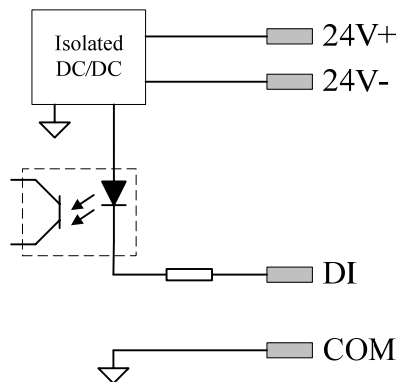


Figure 17 32 Channel Digital Input Equivalent Circuit Diagram

#### 4.4.4 Indication LEDs

LED	Color	State	Description
PWR	Green	ON	The module is powered on
		OFF	The module is not functioning
STA	Green	ON	The onboard system is functioning
		OFF	1) Station number is 0 2) Parameters are corrupted
		Flashing at 50ms ON, 950ms OFF	Parameters do not match the type of module
1	Green	ON	Channel is ON
		OFF	Channel is OFF
2	Green	ON	Channel is ON
		OFF	Channel is OFF
.	.	.	.
.	.	.	.
.	.	.	.
32	Green	ON	Channel is ON
		OFF	Channel is OFF

Table 16 32 Channel Digital Input LED Definitions

#### 4.4.5 Cabling Guide

The pins of 32 Channel Digital Input are located on the front of the module. Their definitions are shown below:

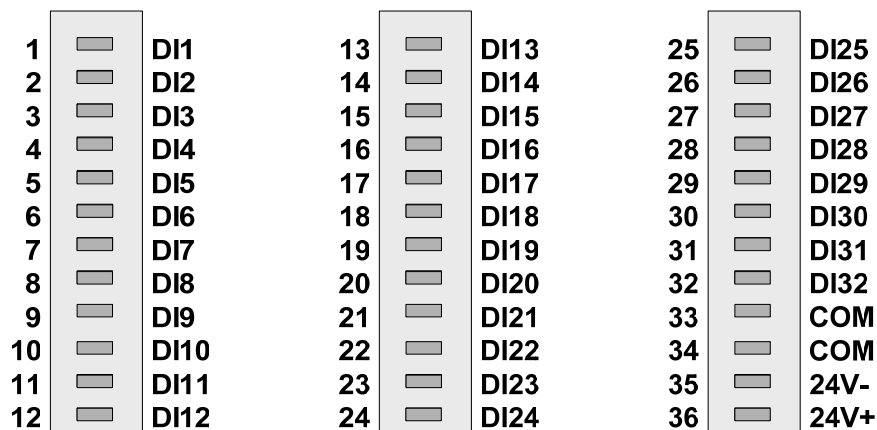


Figure 18 32 Channel Digital Input Pin Definitions

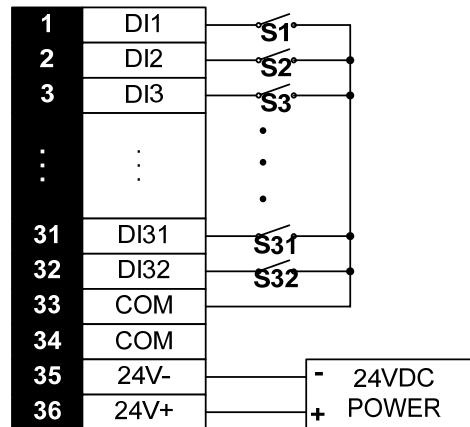


Figure 19 32 Channel Digital Input Cabling Diagram

The module adopts base MX603-7020-01.

#### 4.4.6 Safety Keying

Module Top	1	1	0	1
Base Top	0	0	1	0
Module Bottom	1	0	1	0
Base Bottom	0	1	0	1

Table 17 32 Channel Digital Input Safety Keying

#### 4.4.7 Configurable Channel Parameters

##### ▪ Type of Channel

This parameter allows the user to change the input type of each channel. e.g. counter or latch.

**Only Discrete Input:** The channel only accepts discrete input with ON or OFF indication.

**Only Enable Counter:** The channel gives a counter value.

**Enable Counter and Frequency:** The channel gives counter and frequency values.

**Only Enable Latch High:** If the channel is OFF, and unlatch register is ON, when an ON signal comes, the ON status will be latched for this channel, until both unlatch register and signal recover to OFF.

**Only Enable Latch Low:** If the channel is ON, and unlatch register is OFF, when an OFF signal comes, the OFF status will be latched for this channel, until both unlatch register and signal recover to ON.

The factory default is “Only Discrete Input” for all channels.

- ***Filter Time (ms)***

The *Filter Time* is the length of time that a newly changed input to some channel should last for before it is accepted as a valid input.

It is used to eliminate input noise. If the *filter time* is zero then there is no filter on this channel. The factory default value is "0ms".

## 4.5 32 Channel Digital Output 24VDC Front-wiring

---MX603-5232-123

The MOX 603 32 Channel Digital Output module has 32 non-isolated 24VDC channel outputs. The module powered output channels of the module are used to switch relays and other low-power devices.

### 4.5.1 Familiarization

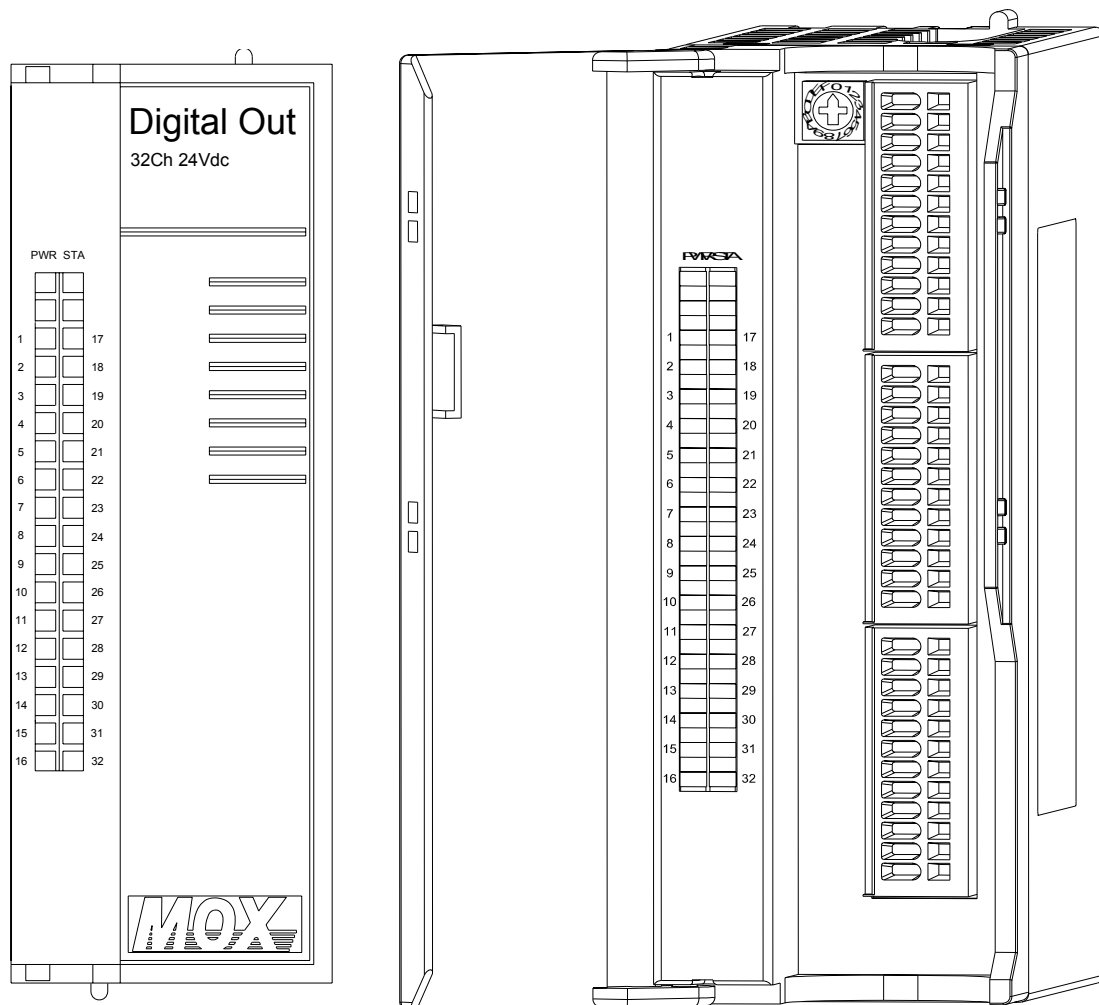


Figure 20 32 Channel Digital Output Familiarization

#### 4.5.2 Datasheet

<b>Output Specifications</b>	
Number of channels	32
Maximum output current per channel	100mA
Maximum output voltage of the output channel	24VDC
Off leakage current (@25°C)	<25uA
<b>Configuration Parameters</b>	
Predef value	OFF, ON
Fail-safe value of channel	Last Value, Predef Value
Type	Discrete Output, Single Pulse, Continuous Pulse
Pulse width (High, 20ms/unit)	User Definable
Pulse width (Low, 20ms/unit)	User Definable
<b>Isolation Specifications</b>	
Channel to system	2500Vrms
<b>Environmental Conditions</b>	
Operating temperature	-20 ~55 °C
Storage temperature	-40 ~85 °C
Relative humidity	5~95%, non-condensing
<b>Hazardous Location Specifications</b>	
Zone 2 Compliance	IEC60079-0 and IEC60079-15 ("nA")
<b>Power Consumption</b>	
Power Consumption	<1.0W

Table 18 32 Channel Digital Output Datasheet

#### 4.5.3 Equivalent Circuit Diagram

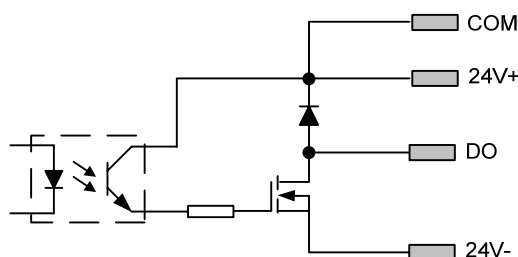


Figure 21 32 Channel Digital Output Equivalent Circuit Diagram



#### 4.5.4 Indication LEDs

LED	Color	State	Description
PWR	Green	ON	The module is powered on
		OFF	The module is not functioning
STA	Green	ON	The onboard system is functioning
		OFF	1) Station number is 0 2) Parameters are corrupted
		Flashing at 50ms ON, 950ms OFF	Parameters do not match the type of module
1	Green	ON	Channel is ON
		OFF	Channel is OFF
2	Green	ON	Channel is ON
		OFF	Channel is OFF
.	.	.	.
.	.	.	.
.	.	.	.
32	Green	ON	Channel is ON
		OFF	Channel is OFF

Table 19 32 Channel Digital Output LED Definitions

#### 4.5.5 Cabling Guide

The pins of 32 Channel Digital Output are located on the front of the module. Their definitions are shown below:

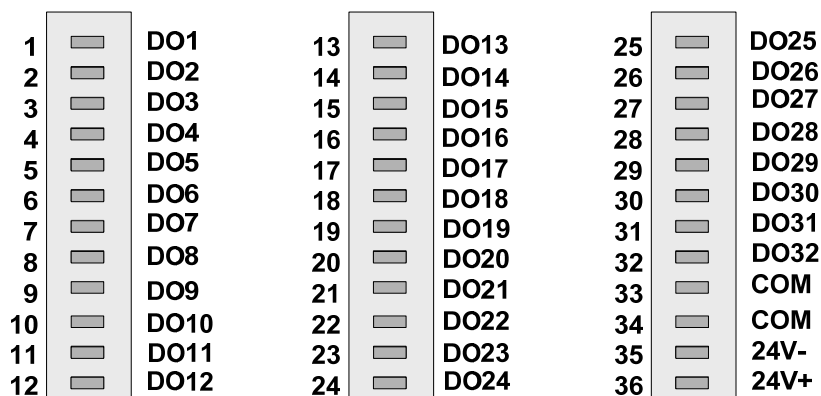
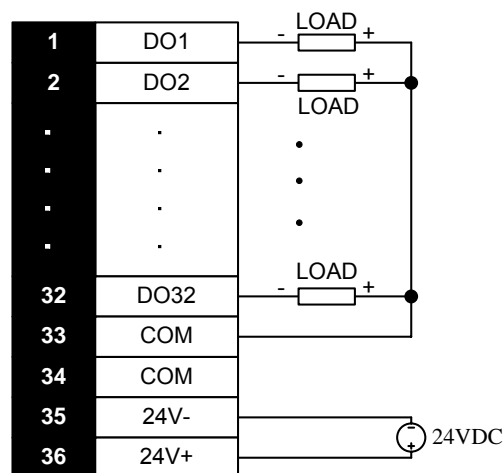


Figure 22 32 Channel Digital Output Pin Definitions



**Figure 23 32 Channel Digital Output Cabling Diagram**

The module adopts base MX603-7020-01.

#### 4.5.6 Safety Keying

Module Top	1	1	0	1
Base Top	0	0	1	0
Module Bottom	1	0	1	0
Base Bottom	0	1	0	1

**Table 20 32 Channel Digital Output Safety Keying**

#### 4.5.7 Configurable Channel Parameters

##### ▪ **Predefined value**

This parameter is the value set to each channel on power-up of the module, e.g. “OFF” or “ON”.

This value is user defined and can be configured for each channel. This parameter can have the following values:

- OFF, ON

The factory default is “OFF” for this parameter.

##### ▪ **Fail-safe value**

This parameter enables the user to configure a value to be used when communication with the module fails. The user configurable options are:

- Last value – last known state of the channel
- Predefined value – the value is taken from the predefined parameter

The factory default is “Last value” for this parameter.

- **Type of channel**

This parameter enables the user to configure the channel output type. The user configurable options are:

**Discrete Output:** The channel output will remain constant as the controller requires.

**Single Pulse:** When working in single pulse mode, “1” means starting one high level period. The period length is defined in the *Pulse Width* parameter. When the high level period time expires, the output will be kept low. “0” means canceling the last starting action; before starting the next single pulse, the canceling “0” is required.

**Continuous Pulse:** When working in continuous pulse mode, ‘1’ means starting a continuous pulse, the high and low period lengths of which are defined in *Pulse Width* parameter. ‘0’ means canceling the last starting action.

The factory default is “Discrete Output” for this parameter.

- **Pulse width (High and Low) of channel**

This parameter is used to define the *pulse width* in conjunction with the “*Type of channel*” parameter when the *Single Pulse* or *Continuous Pulse* option is set. The high width and low width are configured separately; the unit is 20ms. If the low width is set to 0, it will be forced to be equal to the high width. The user configurable parameters are:

- ◆ **0-255**

The factory default is “0” for this parameter. For *Single Pulse* and *Continuous Pulse*, “0” means the minimum width which is 20ms.

## 4.6 12 Channel Analog Input 4-20mA Front-wiring

---MX603-5312-113

The MOX 603 12 Channel Analog Input 4-20mA module is a front wiring module. It has 12 analog 4-20mA current inputs.

### 4.6.1 Familiarization

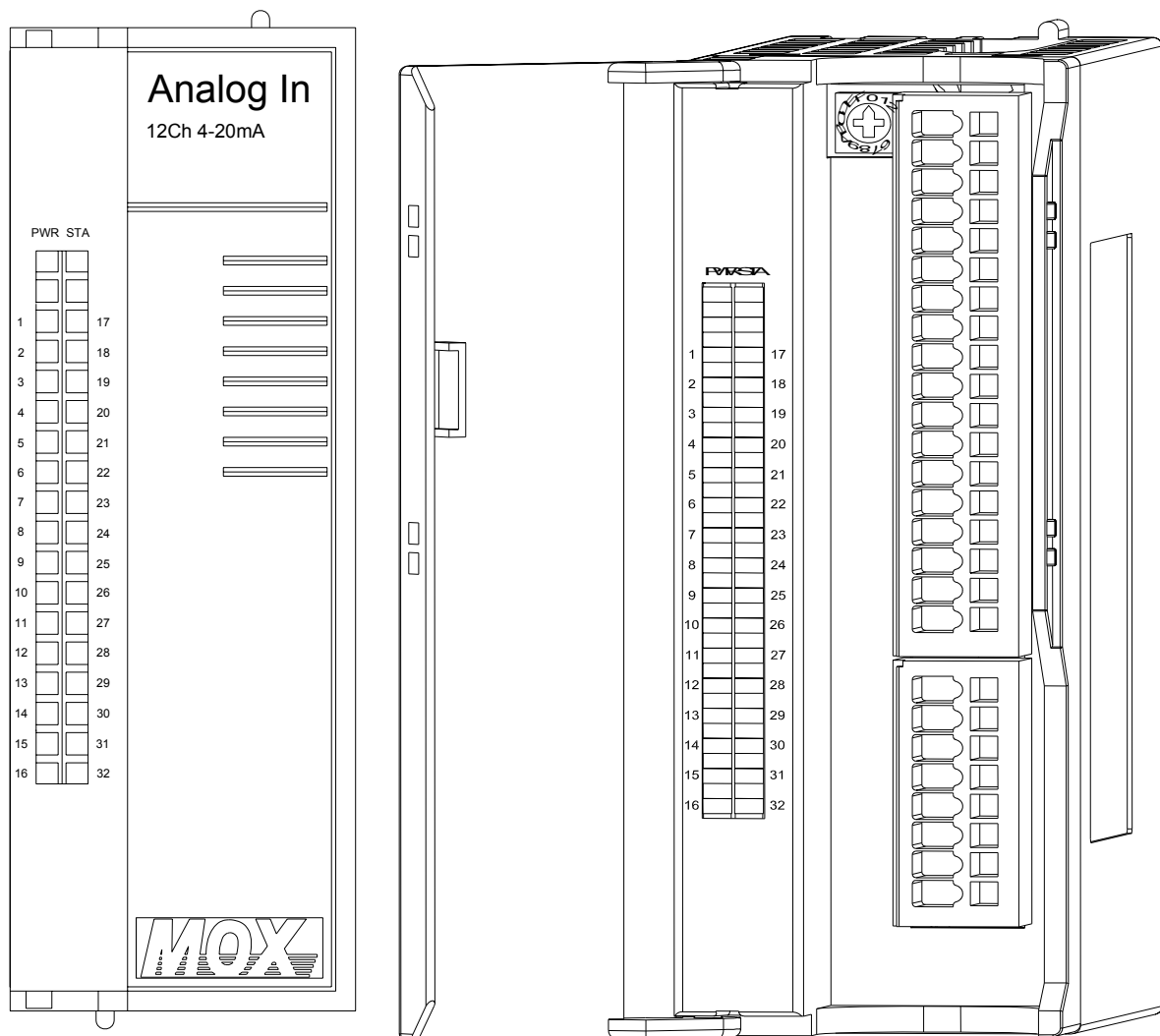


Figure 24 12 Channel Analog Input 4-20mA Familiarization

### 4.6.2 Datasheet

#### Input Specifications

Number of channels	12
Nominal signal range (span)	4-20mA
Full signal range	0.5-22mA
Line fault detection	<0.5mA
Resolution of ADC chip	24bits
Input resistance (@20mA)	<200Ω
Accuracy (@25 °C)	± 20μA
Temperature stability (-20°C to +55°C)	± 0.006% of span per °C
<b>Isolation Specifications</b>	
Channel to system	1000Vrms
Permissible potential difference between channels	<400VDC
<b>Configurable Parameters</b>	
Activate channel	Activate, Deactivate
Filter times	User Definable
<b>Environmental Conditions</b>	
Operating temperature	-20 to 55°C
Storage temperature	-40 to 85°C
Relative humidity	5 to 95%, non-condensing
<b>Hazardous Location Specifications</b>	
Zone 2 Compliance	IEC60079-0 and IEC60079-15 ("nA")
<b>Power Consumption</b>	
Power Consumption	<1.6W

Table 21 12 Channel Analog Input 4-20mA Datasheet

#### 4.6.3 Equivalent Circuit Diagram

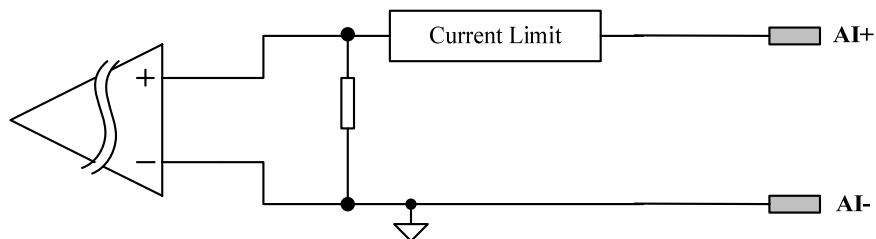


Figure 25 12 Channel Analog Input 4-20mA Equivalent Circuit Diagram

#### 4.6.4 Indication LEDs

LED	Color	State	Description
PWR	Green	ON	The module is powered on
		OFF	The module is not functioning
STA	Green	ON	The onboard system is functioning
		OFF	1) Station number is 0 2) Parameters are corrupted
		Flashing at 50ms ON, 950ms OFF	Parameters do not match the type of module
1	Orange	ON	Channel is ON
		OFF	Channel is OFF
2	Orange	ON	Channel is ON
		OFF	Channel is OFF
.	.	.	.
.	.	.	.
.	.	.	.
12	Orange	ON	Channel is ON
		OFF	Channel is OFF

Table 22 12 Channel Analog Input 4-20mA LED Definitions

#### 4.6.5 Cabling Guide

The pins of 12 Channel Analog Input 4-20mA are located on the front of the module. Their definitions are shown below:

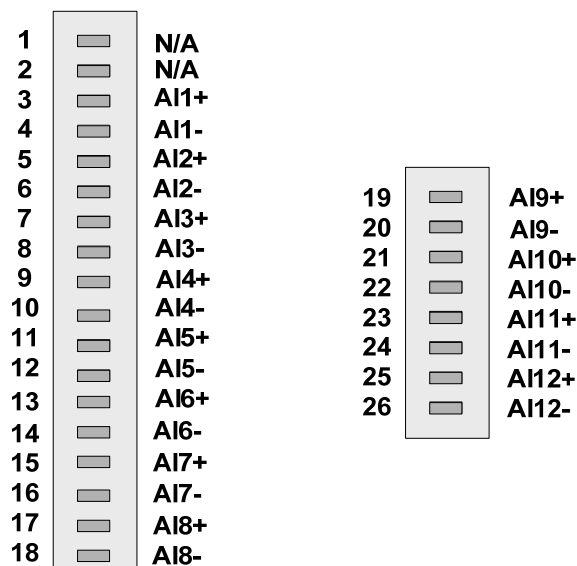


Figure 26 12 Channel Analog Input 4-20mA Pin Definitions

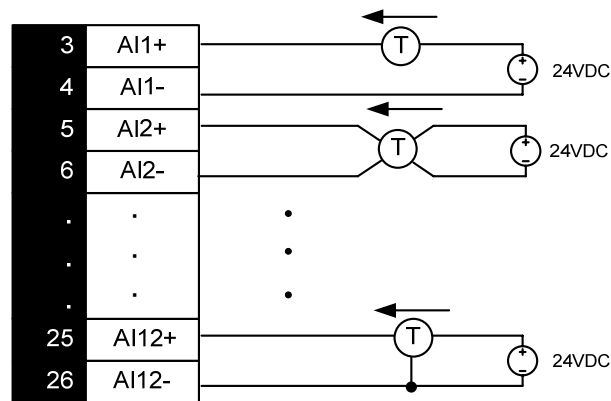


Figure 27 12 Channel Analog Input 4-20mA Wiring Diagram

The module adopts base MX603-7020-01.

#### 4.6.6 Safety Keying

Module Top	1	1	0	1
Base Top	0	0	1	0
Module Bottom	1	0	1	0
Base Bottom	0	1	0	1

Table 23 12 Channel Analog Input 4-20mA Safety Keying

#### 4.6.7 Configurable Channel Parameters

##### ▪ Activate Channel

The users are able to activate/deactivate any channel they desire through this parameter. Each channel has this attribute and as such its status can be manipulated by altering this parameter.

The factory default is “activated” for all channels.

##### ▪ Filter Times

This value is the number of times the controller will sample the input before taking an average. This value is user definable. This parameter is a way of smoothing the input from the field device.

The factory set default is “0” for this parameter.

## 4.7 12 Channel Analog Input 1-5VDC Front-wiring

### ---MX603-5312-123

The MOX 603 12 Channel Analog Input 1-5VDC module is a front wiring module. It has 12 analog 1-5VDC inputs. This module provides over voltage protection. It also has the function of filtering and data processing of the input signal.

#### 4.7.1 Familiarization

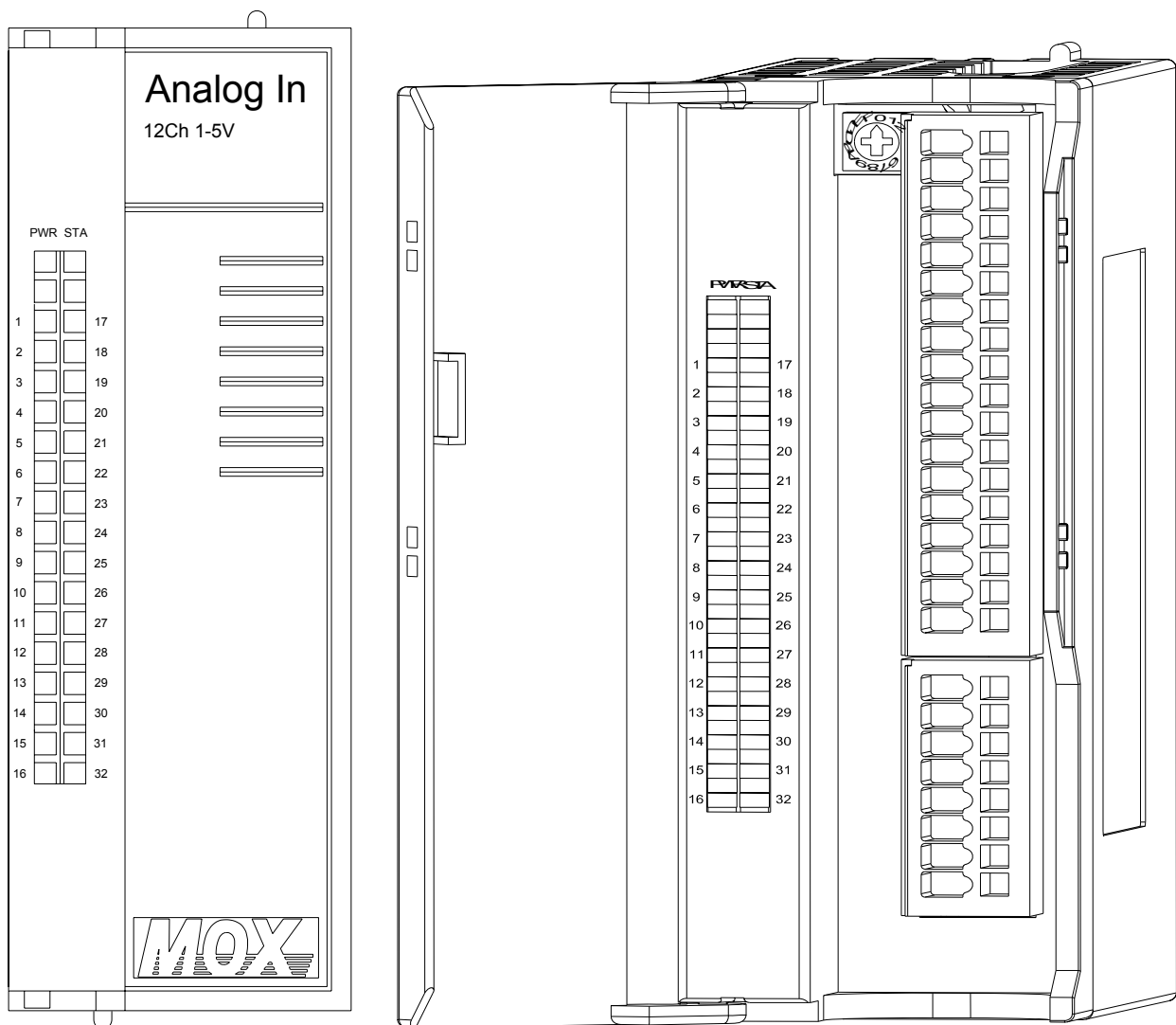


Figure 28 12 Channel Analog Input 1-5V Familiarization



#### 4.7.2 Datasheet

Input Specifications	
Number of channels	12
Nominal signal range (span)	1-5VDC
Full signal range	0.2-5.5V
Line fault detection	<0.2V
Resolution of ADC chip	24bits
Input resistance	>1M $\Omega$
Accuracy (@25°C)	$\pm 5$ mV
Temperature stability (-20°C to +55°C)	$\pm 0.006\%$ of span per °C
Isolation Specifications	
Channel to system	1000Vrms
Permissible potential difference between channels	<400VDC
Configurable Parameters	
Activate channel	Activate, Deactivate
Filter times	User Definable
Environmental Conditions	
Operating temperature	-20 to 55°C
Storage temperature	-40 to 85°C
Relative humidity	5 to 95%, non-condensing
Hazardous Location Specifications	
Zone 2 Compliance	IEC60079-0 and IEC60079-15 ("nA")
Power Consumption	
Power Consumption	<1.6W

Table 24 12 Channel Analog Input 1-5V Datasheet

#### 4.7.3 Equivalent Circuit Diagram

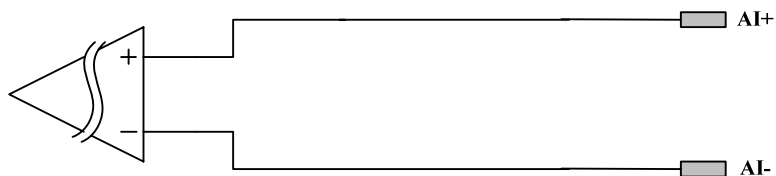


Figure 29 12 Channel Analog Input 1-5V Equivalent Circuit Diagram

#### 4.7.4 Indication LEDs

LED	Color	State	Description
PWR	Green	ON	The module is powered on
		OFF	The module is not functioning
STA	Green	ON	The onboard system is functioning
		OFF	1) Station number is 0 2) Parameters are corrupted
		Flashing at 50ms ON, 950ms OFF	Parameters do not match the type of module
1	Orange	ON	Channel is ON
		OFF	Channel is OFF
2	Orange	ON	Channel is ON
		OFF	Channel is OFF
.	.	.	.
.	.	.	.
.	.	.	.
12	Orange	ON	Channel is ON
		OFF	Channel is OFF

Table 25 12 Channel Analog Input 1-5V LED Definitions

#### 4.7.5 Cabling Guide

The pins of 12 Channel Analog Input 1-5V are located on the front of the module. Their definitions are shown below:

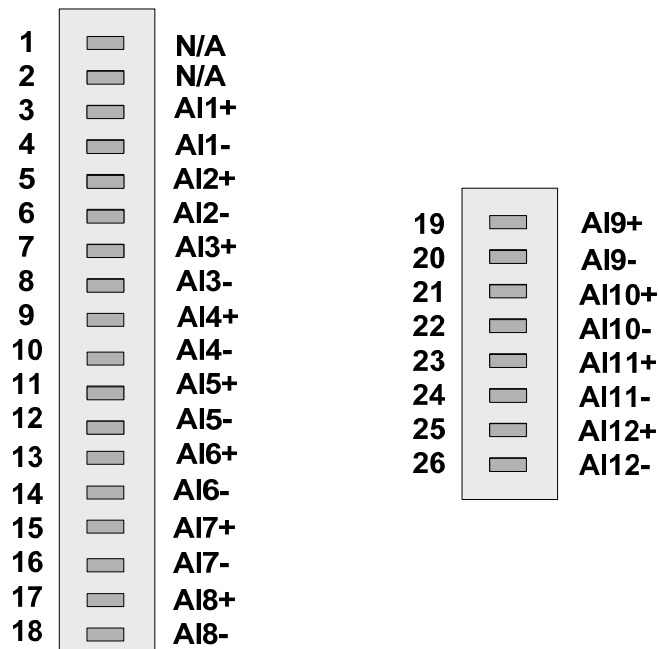


Figure 30 12 Channel Analog Input 1-5V Pin Definitions

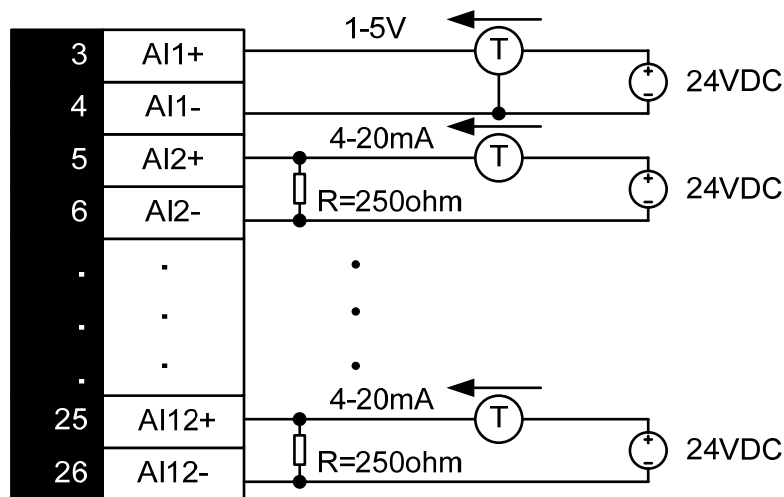


Figure 31 12 Channel Analog Input 1-5V Wiring Diagram

The module adopts base MX603-7020-01.

#### 4.7.6 Safety Keying

Module Top	1	1	0	1
Base Top	0	0	1	0
Module Bottom	1	0	1	0
Base Bottom	0	1	0	1

Table 26 12 Channel Analog Input 1-5V Safety Keying

#### 4.7.7 Configurable Channel Parameters

##### ▪ Activate Channel

The users are able to activate/deactivate any channel they desire through this parameter. Each channel has this attribute and as such its status can be manipulated by altering this parameter.

The factory default is “activated” for all channels.

##### ▪ Filter Times

This value is the number of times the controller will sample the input before taking an average. This value is user definable. This parameter is a way of smoothing the input from the field device.

The factory set default is “0” for this parameter.

## 4.8 12 Channel Analog Input 4-20mA Front-wiring

---MX603-5312-133

This MOX 603 12 Channel Analog Input 4-20mA module is a front wiring module. It has 12 analog 4-20mA inputs.

The 12 channels are divided into 3 groups, with 4 channels of each group. Each group is isolated from each other and can connect to either 2-wire or 4-wire instruments.

### 4.8.1 Familiarization

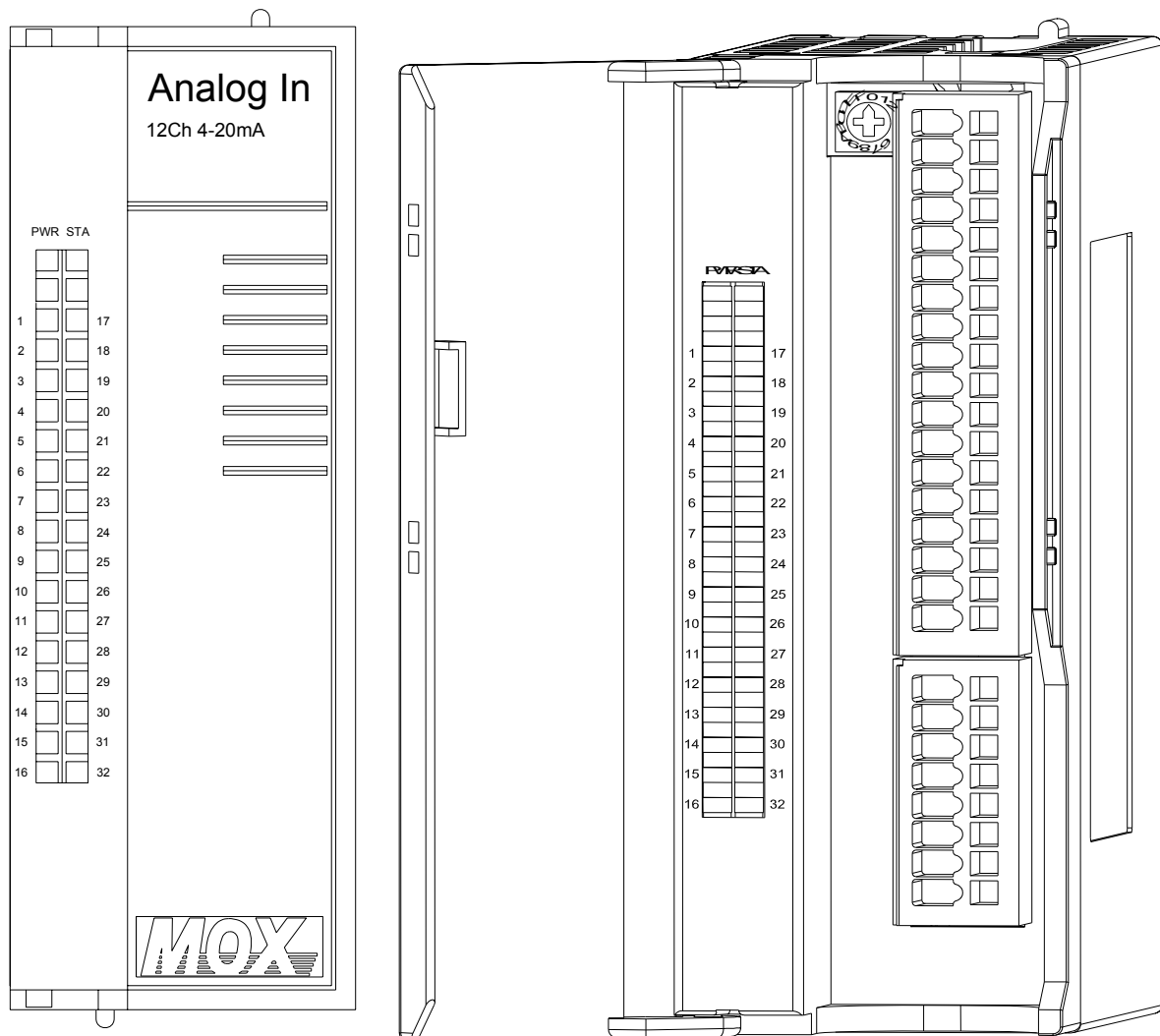


Figure 32 12 Channel Analog Input 4-20mA Familiarization

#### 4.8.2 Datasheet

<b>Input Specifications</b>	
Number of channels	12
Number of channel groups	3
Channels of each group	4
Nominal signal range (span)	4 – 20mA
Full signal range	0.5 – 22mA
Line fault detection	<0.5mA
Resolution of ADC chip	24bits
Input resistance	<100Ω
Accuracy (@25°C)	± 20μA
Temperature stability (-20°C to +55°C)	± 0.006% of span per °C
<b>Isolation Specifications</b>	
Channel to system	1000Vrms
Channel group to channel group	1000Vrms
<b>Over Input Protection</b>	
Maximum input	30V
<b>Configurable Parameters</b>	
Activate channel	Activate, Deactivate
Filter times	User Definable
<b>Auxiliary Power (for 2-wiring instrument)</b>	
Input voltage	24V±10%
Load of 2-wire instrument	<750Ohm
<b>Environmental Conditions</b>	
Operating temperature	-20 to 55°C
Storage temperature	-40 to 85°C
Relative humidity	5 to 95%, non-condensing
<b>Hazardous Location Specifications</b>	
Zone 2 Compliance	IEC60079-0 and IEC60079-15 (“nA”)
<b>Power Consumption</b>	
Power Consumption	<1.6W

Table 27 12 Channel Analog Input 4-20mA Datasheet

### 4.8.3 Equivalent Circuit Diagram

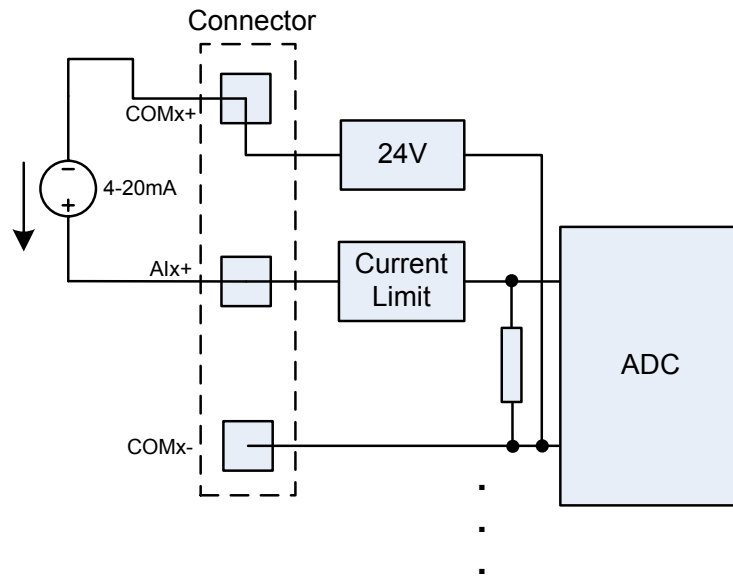


Figure 33 12 Channel Analog Input 4-20mA Connecting to 2-wiring Instrument

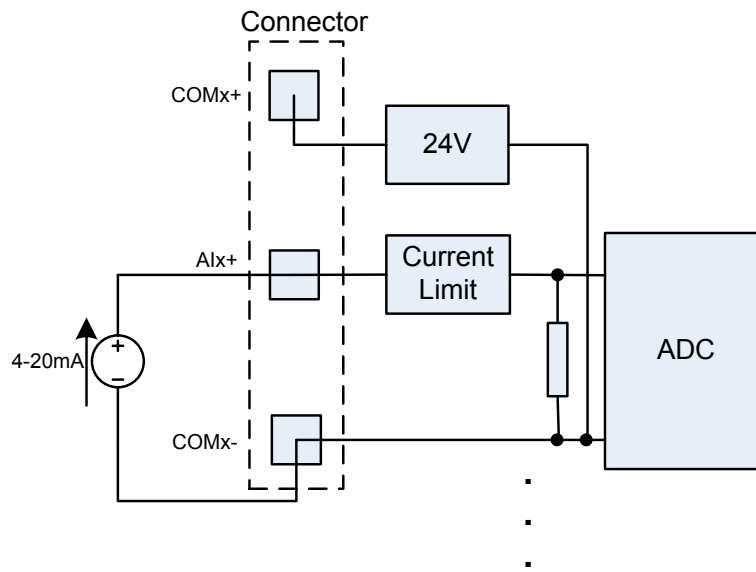


Figure 34 12 Channel Analog Input 4-20mA Connecting to 4-wiring Instrument

#### 4.8.4 Indication LEDs

LED	Color	State	Description
PWR	Green	ON	The module is powered on
		OFF	The module is not functioning
STA	Green	ON	The onboard system is functioning
		OFF	1) Station number is 0 2) Parameters are corrupted
		Flashing at 50ms ON, 950ms OFF	Parameters do not match the type of module
1	Orange	ON	Channel is ON
		OFF	Channel is OFF
2	Orange	ON	Channel is ON
		OFF	Channel is OFF
.	.	.	.
.	.	.	.
.	.	.	.
12	Orange	ON	Channel is ON
		OFF	Channel is OFF

Table 28 12 Channel Analog Input 4-20mA LED Definitions

#### 4.8.5 Cabling Guide

The pins of 12 Channel Analog Input 4-20mA are located on the front of the module. Their definitions are shown below:

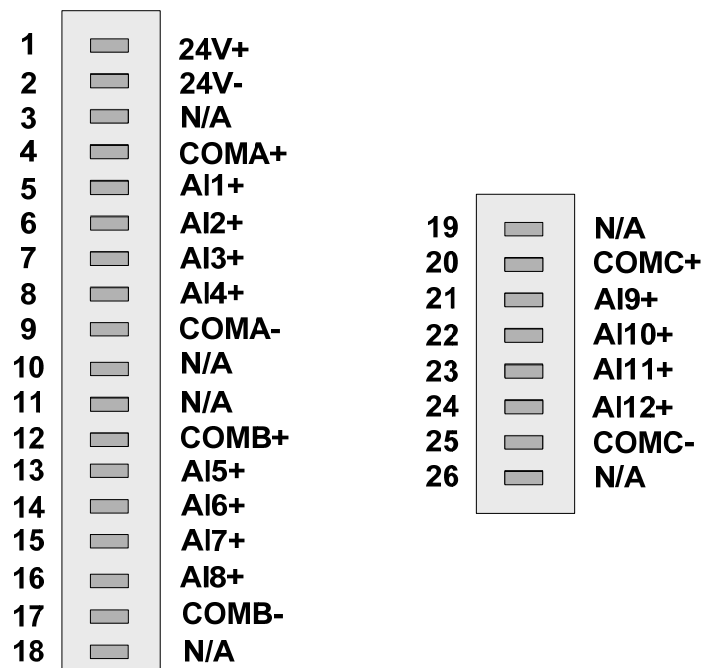


Figure 35 12 Channel Analog Input 4-20mA Pin Definitions

Each channel group can connect to either 2-wiring or 4-wiring instruments. However, only one connection is permitted within one channel group.

The following figures give the examples that 12AI 4-20mA Front-wiring card connect to the 2-wiring instruments as well as 4-wiring instruments.

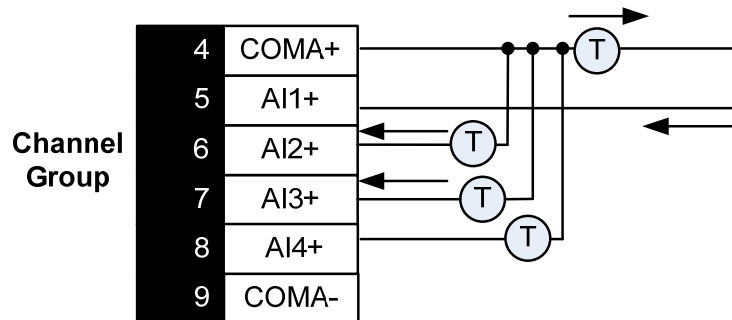


Figure 36 Typical 2-wiring Instruments Connection

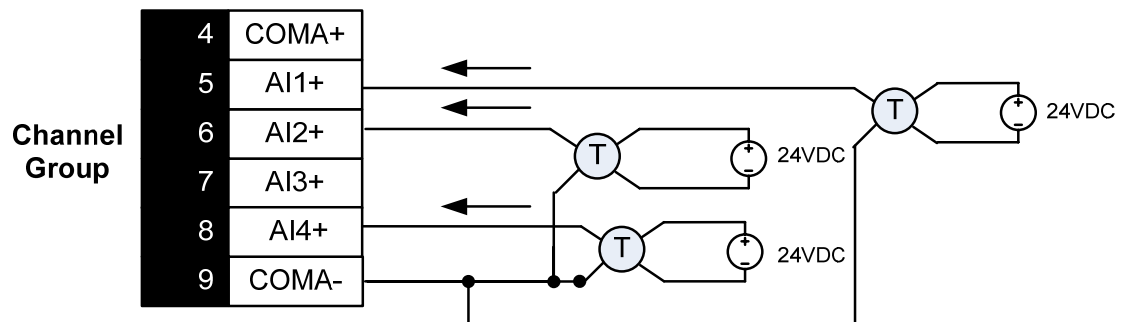


Figure 37 Typical 4-wiring Instruments Connection

The module adopts base MX603-7020-01.

#### 4.8.6 Safety Keying

Module Top	1	1	0	1
Base Top	0	0	1	0
Module Bottom	1	0	1	0
Base Bottom	0	1	0	1

Table 29 12 Channel Analog Input 4-20mA Safety Keying

#### 4.8.7 Configurable Channel Parameters

##### ▪ Activate Channel

The users are able to activate/deactivate any channel they desire through this parameter. Each channel has this attribute and as such its status can be manipulated by altering this parameter.



The factory default is “activated” for all channels.

- ***Filter Times***

This value is the number of times the controller will sample the input before taking an average. This value is user definable. This parameter is a way of smoothing the input from the field device.

The factory set default is “0” for this parameter.

## 4.9 12 Channel TC Front-wiring

### ---MX603-5512-823

The MOX 603 12 Channel Thermal Couple (TC) input or mV input Module has the capability of sampling analog mV signal inputs and converting them into digital format, detecting a sensor break on individual inputs as well as filtering and data processing of the input signal.

#### 4.9.1 Familiarization

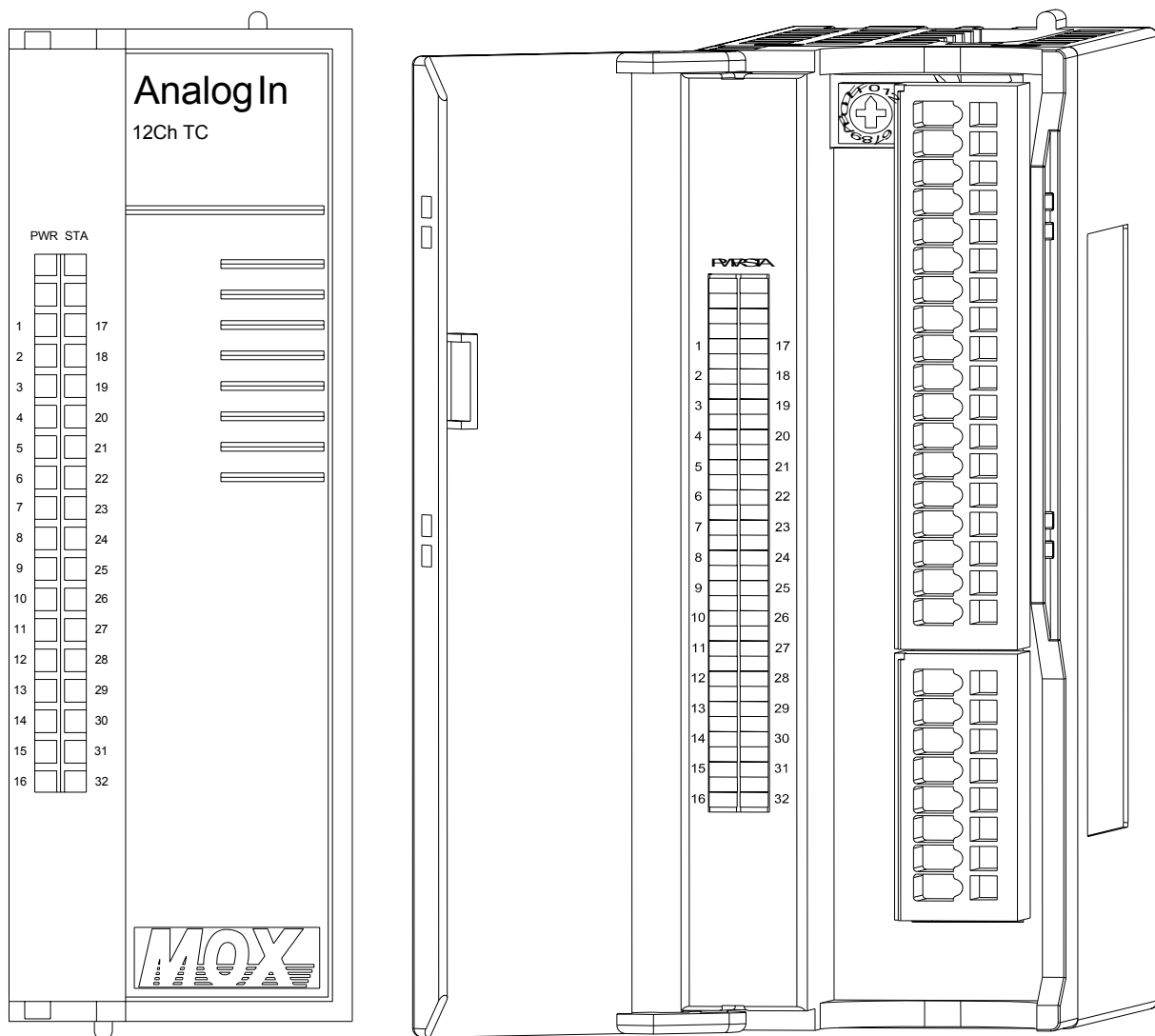


Figure 38 12 Channel TC Familiarization

#### 4.9.2 Datasheet

Input Specifications	
Number of channels	12
Input type	J, K, T, E, N, B, R, S, mV
Input voltage range	-12mV~78mV
Resolution of ADC chip	24bits
Accuracy (@25°C)	±0.1%
Temperature stability (-20°C~+55°C)	± 0.006% of span per °C
Cold junction compensation accuracy*	±1°C
Isolation Specifications	
Channel to system	2500Vrms
Permissible potential difference between channels	<400VDC
Configurable Parameters	
Check line status	User Definable
Activate channel	Activate, Deactivate
Sensor type	J, K, T, E, N, B, R, S, mV
Filter times	User Definable
Environmental Conditions	
Operating temperature	-20 to 55°C
Storage temperature	-40 to 85°C
Relative humidity	5 to 95%, non-condensing
Hazardous Location Specifications	
Zone 2 Compliance	IEC60079-0 and IEC60079-15 ("nA")
Power Consumption	
Power Consumption	<3.3W

\*When Pt (1000) RTD (MX603-00-16006) is used for cold junction.

Table 30 12 Channel TC Datasheet

#### 4.9.3 Equivalent Circuit Diagram

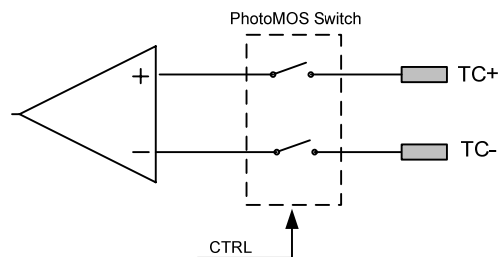


Figure 39 12 Channel TC Equivalent Circuit Diagram

#### 4.9.4 Indication LEDs

LED	Color	State	Description
PWR	Green	ON	The module is powered on
		OFF	The module is not functioning
STA	Green	ON	The onboard system is functioning
		OFF	1) Station number is 0 2) Parameters are corrupted
		Flashing at 50ms ON, 950ms OFF	Parameters do not match the type of module
1	Orange	ON	Channel is ON
		OFF	Channel is OFF
2	Orange	ON	Channel is ON
		OFF	Channel is OFF
.	.	.	.
.	.	.	.
.	.	.	.
12	Orange	ON	Channel is ON
		OFF	Channel is OFF

Table 31 12 Channel TC LED Definitions

#### 4.9.5 Cabling Guide

The pins of 12 Channel TC are located on the front of the module. Their definitions are shown below:

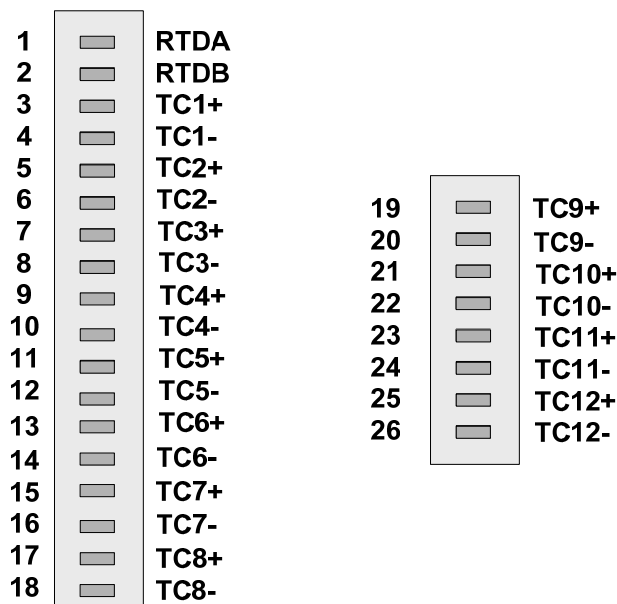


Figure 40 12 Channel TC Pin Definitions

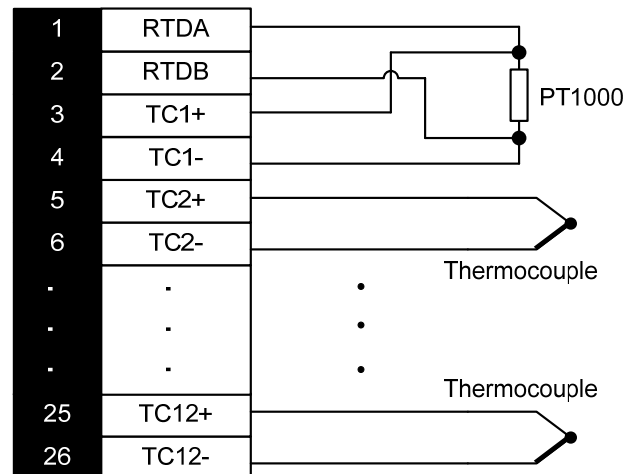


Figure 41 12 Channel TC Cabling Diagram

The module adopts base MX603-7020-01.

#### 4.9.6 Safety Keying

Module Top	1	1	0	1
Base Top	0	0	1	0
Module Bottom	1	0	1	0
Base Bottom	0	1	0	1

Table 32 12 Channel TC Safety Keying

#### 4.9.7 Configurable Channel Parameters

##### ▪ Activate Channel

The users are able to activate/deactivate any channel they desire through this parameter. Each channel has this attribute and as such its status can be manipulated by altering this parameter.

The factory default is “activated” for all channels.

##### ▪ Check Line Status Interval (s)

This parameter allows the user to set the time period of refresh for the line status of all channels. This parameter is user defined.

The factory default is “10” for this parameter.

- **Sensor Type**

This parameter allows the user to select which *sensor type* is connected to which input channel. With the TC module there is a connection combination of 9 different sensors. The TC type can be J, K, E, T, S, R, B, N or mV. Each input is equipped with open circuit detection and over voltage protection. Furthermore, the first channel can be configured as Pt(375)1000 type to detect environment temperature and used as the cold junction compensation for the other TC channels.

The factory default sensor is “J” for this parameter.

- **Filter Times**

This parameter controls the number of times the controller will sample the input before taking an average and is a way of smoothing the input from the field device. This parameter is user definable.

The factory default is “5” for this parameter.

## 4.10 12 Channel RTD Front-wiring

### ---MX603-5612-923

The MOX 603 12 Channel Resistance Temperature Detector (RTD) module has the capability of exciting a current source and sampling analog voltage signal inputs on connected RTD. This module is capable of converting this input into digital format, detecting a sensor break on an individual input channel as well as filtering and data processing of the input signal.

#### 4.10.1 Familiarization

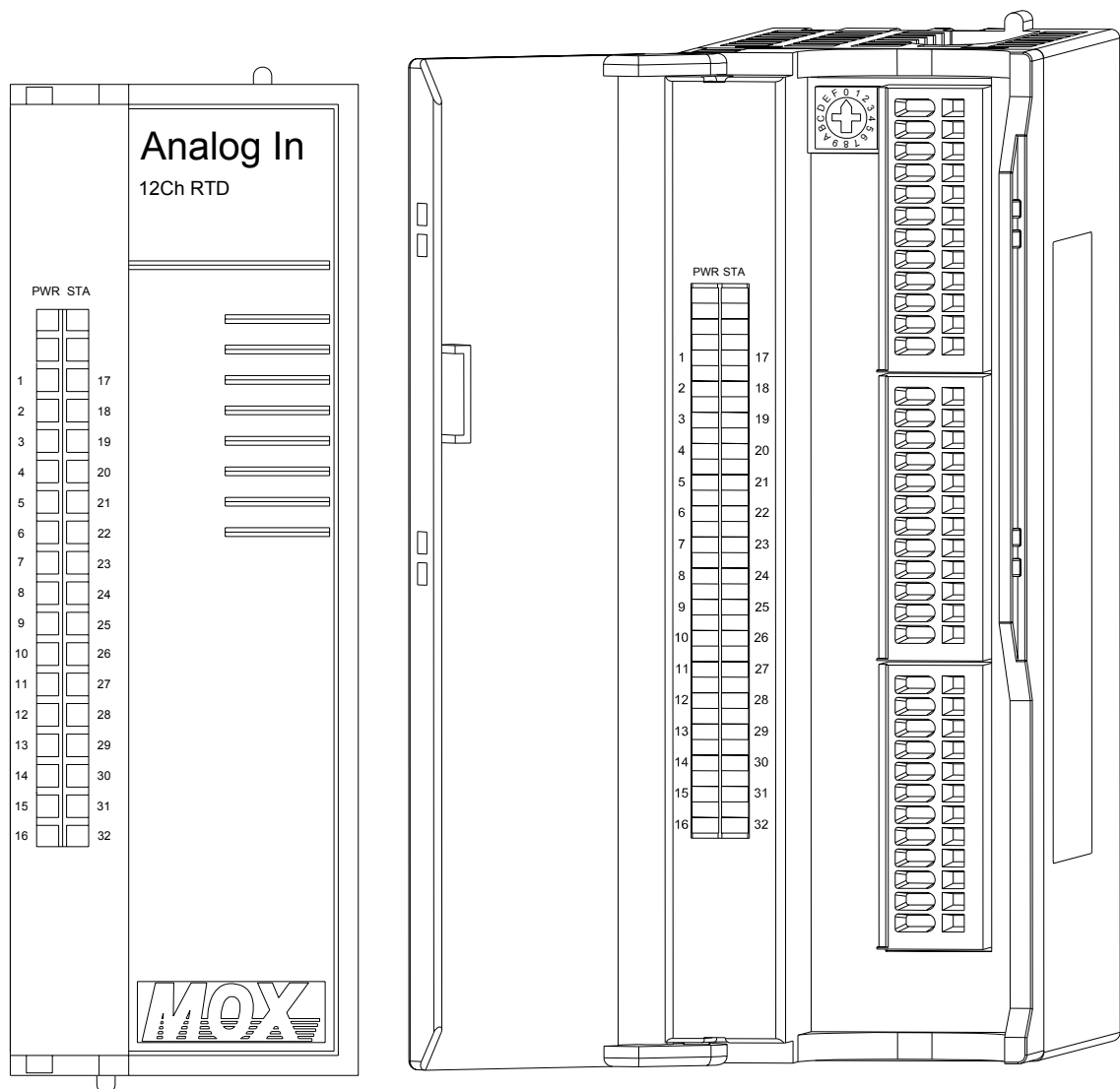


Figure 42 12 Channel RTD Familiarization

#### 4.10.2 Datasheet

Input Specifications	
Number of channels	12
RTD input type	0.00385 series inputs: PT100, PT200, PT500, PT1000 0.00428 series inputs: Cu100, Cu50 $\Omega$ inputs: 0~400 $\Omega$
Excitation current	210 $\mu$ A
Accuracy (@25°C)	$\pm 0.1\%$
Temperature stability (-20°C to +55°C)	PT1000, PT500, PT200, PT100, 0-400 $\Omega$ : $\pm 0.0075\%$ of span per °C Cu100, Cu50: $\pm 0.011\%$ of span per °C
Resolution of ADC chip	24bits
Isolation Specifications	
Channel to system	1000Vrms
Configurable Parameters	
Check line status	User Definable
Activate channel	Activate, Deactivate
Sensor type	PT(385)100, PT(385)200, PT(385)500, PT(385)1000, Cu50, Cu100, 0-400Ohm
Filter times	User Definable
Environmental Conditions	
Operating temperature	-20 to 55°C
Storage temperature	-40 to 85°C
Relative humidity	5% to 95%, non-condensing
Hazardous Location Specifications	
Zone 2 Compliance	IEC60079-0 and IEC60079-15 ("nA")
Power Consumption	
Power Consumption	<1.5 W

Table 33 12 Channel RTD Datasheet

#### 4.10.3 Equivalent Circuit Diagram

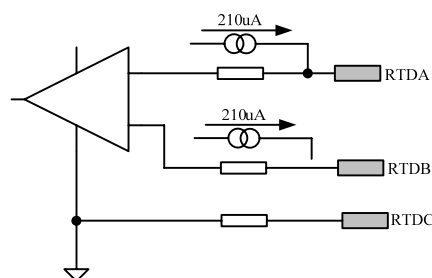


Figure 43 12 Channel RTD Equivalent Circuit Diagram



#### 4.10.4 Indication LEDs

LED	Color	State	Description
PWR	Green	ON	The module is powered on
		OFF	The module is not functioning
STA	Green	ON	The onboard system is functioning
		OFF	1) Station number is 0 2) Parameters are corrupted
		Flashing at 50ms ON, 950ms OFF	Parameters do not match the type of module
1	Orange	ON	Channel is ON
		OFF	Channel is OFF
2	Orange	ON	Channel is ON
		OFF	Channel is OFF
.	.	.	.
.	.	.	.
.	.	.	.
12	Orange	ON	Channel is ON
		OFF	Channel is OFF

Table 34 12 Channel RTD LED Definitions

#### 4.10.5 Cabling Guide

The pins of 12 Channel RTD are located on the front of the module. Their definitions are shown below:





































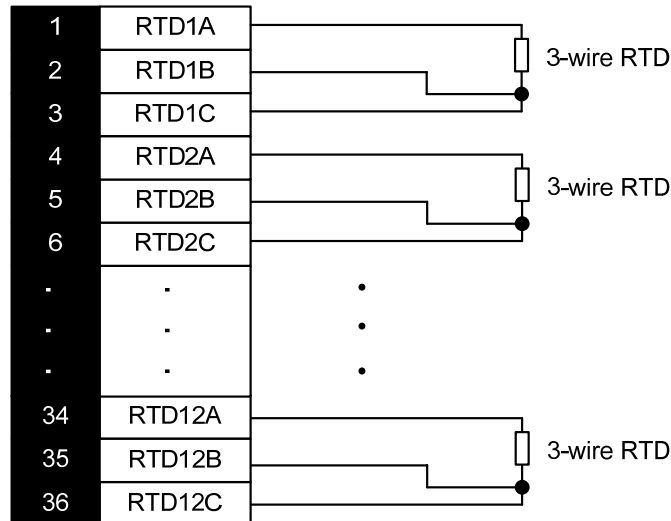
1		RTD1A	13		RTD5A	25		RTD9A
2		RTD1B	14		RTD5B	26		RTD9B
3		RTD1C	15		RTD5C	27		RTD9C
4		RTD2A	16		RTD6A	28		RTD10A
5		RTD2B	17		RTD6B	29		RTD10B
6		RTD2C	18		RTD6C	30		RTD10C
7		RTD3A	19		RTD7A	31		RTD11A
8		RTD3B	20		RTD7B	32		RTD11B
9		RTD3C	21		RTD7C	33		RTD11C
10		RTD4A	22		RTD8A	34		RTD12A
11		RTD4B	23		RTD8B	35		RTD12B
12		RTD4C	24		RTD8C	36		RTD12C

Figure 44 12 Channel RTD Pin Definitions



**Figure 45 12 Channel RTD Wiring Diagram**

The module adopts base MX603-7020-01.

In order to ensure the accuracy, the resistance of the cable lead wires must be equal to or less than  $0.01\Omega$ . It is recommended to adopt the cable with high quality which has small tolerance rating and the lead resistance is less than  $20\Omega$ . So the lead wires match as closely as possible.

#### 4.10.6 Safety Keying

Module Top	1	1	0	1
Base Top	0	0	1	0
Module Bottom	1	0	1	0
Base Bottom	0	1	0	1

**Table 35 12 Channel RTD Safety Keying**

#### 4.10.7 Configurable Channel Parameters

##### ▪ **Activate Channel**

The users are able to activate/deactivate any channel they desire through this parameter. Each channel has this attribute and as such its status can be manipulated by altering this parameter.

The factory default is “activated” for all channels.

##### ▪ **Check Line Status Interval (s)**

This parameter allows the user to set the time period of refresh for the line status of all channels. This parameter is user defined.

The factory default is “10” for this parameter.

- **Sensor Type**

This parameter allows the user to select which *sensor type* is connected to which input channel. The *sensor type* includes: PT(385)100, PT(385)200, PT(385)500, PT(385)1000, Cu50, Cu100, 0-400Ohm.

The factory default sensor is the "PT(385)100" for this parameter.

- **Filter Times**

This parameter controls the number of times the controller will sample the input before taking an average and is a way of smoothing the input from the field device. This parameter is user definable.

The factory default is "0" for this parameter.

## 4.11 8 Channel Analog Output 4-20mA Isolated Module Power Front-wiring

---MX603-5408-123

The MOX 603 8 Channel Analog Output Isolated 4-20mA Module Power module supports 8 individually isolated 4-20mA outputs. It has the capability of providing analog current signals, detecting an open circuit on individual output channels.

### 4.11.1 Familiarization

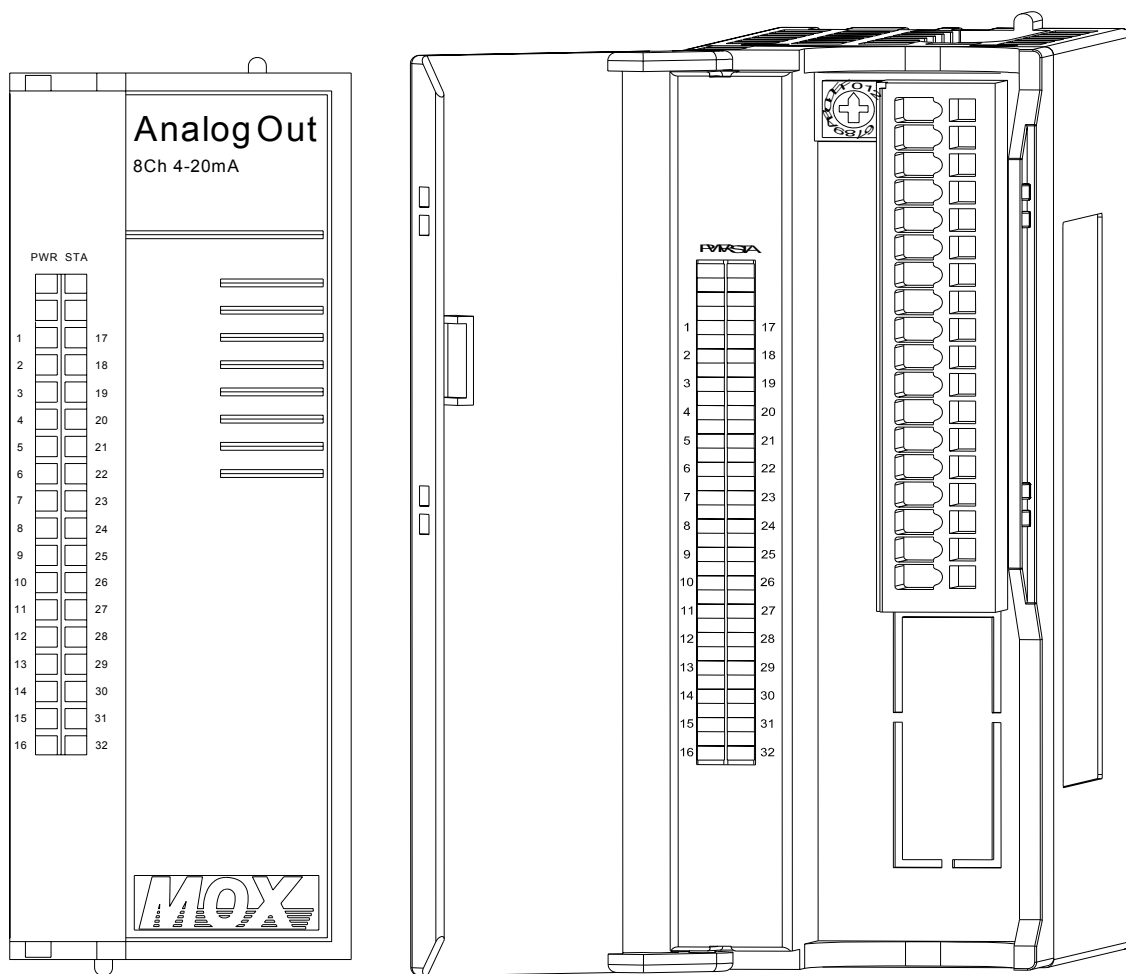


Figure 46 8 Channel Analog Output 4-20mA Isolated Familiarization

#### 4.11.2 Datasheet

Output Specifications	
Number of channels	8
Nominal signal range (span)	4~20mA
Load resistance (@20mA)	0~750Ω
Resolution of DAC chip	12bits
Accuracy (@25°C)	± 20μA
Temperature stability (-20°C to +55°C)	± 0.006% of span per °C
Isolation Specifications	
Channel to system	1000Vrms
Channel to Channel	1000Vrms
Configurable Parameters	
Activate channel	Activate, Deactivate
Predef value	User Definable
Drive on failsafe value	User Definable
Environmental Conditions	
Operating temperature	-20 to 55°C
Storage temperature	-40 to 85°C
Relative humidity	5 to 95%, non-condensing
Hazardous Location Specifications	
Zone 2 Compliance	IEC60079-0 and IEC60079-15 ("nA")
Power Consumption	
Power Consumption	<1.0W

Table 36 8 Channel Analog Output 4-20mA Isolated Datasheet

#### 4.11.3 Equivalent Circuit Diagram

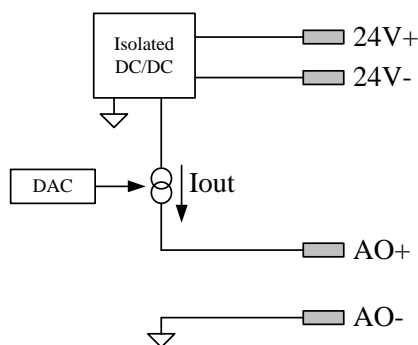


Figure 47 8 Channel Analog Output 4-20mA Isolated Equivalent Circuit Diagram

#### 4.11.4 Indication LEDs

LED	Color	State	Description
PWR	Green	ON	The module is powered on
		OFF	The module is not functioning
STA	Green	ON	The onboard system is functioning
		OFF	1) Station number is 0 2) Parameters are corrupted
		Flashing at 50ms ON, 950ms OFF	Parameters do not match the type of module
1	Orange	ON	Channel is ON
		OFF	Channel is OFF
2	Orange	ON	Channel is ON
		OFF	Channel is OFF
.	.	.	.
.	.	.	.
.	.	.	.
8	Orange	ON	Channel is ON
		OFF	Channel is OFF

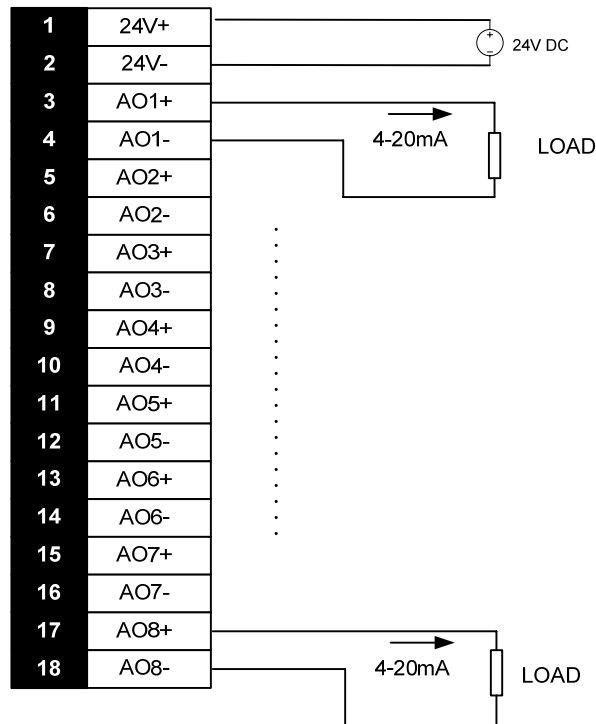
Table 37 8 Channel Analog Output 4-20mA Isolated LED Definitions

#### 4.11.5 Cabling Guide

The pins of 8 Channel Analog Output 4-20mA Isolated are located on the front of the module. Their definitions are shown below:

1		24V+
2		24V-
3		AO1+
4		AO1-
5		AO2+
6		AO2-
7		AO3+
8		AO3-
9		AO4+
10		AO4-
11		AO5+
12		AO5-
13		AO6+
14		AO6-
15		AO7+
16		AO7-
17		AO8+
18		AO8-

Figure 48 8 Channel Analog Output 4-20mA Isolated Pin Definitions



**Figure 49** 8 Channel Analog Output 4-20mA Isolated Cabling Diagram

The module adopts base MX603-7020-01.

#### 4.11.6 Safety Keying

Module Top	1	1	0	1
Base Top	0	0	1	0
Module Bottom	1	0	1	0
Base Bottom	0	1	0	1

**Table 38** 8 Channel Analog Output 4-20mA Isolated Safety Keying

#### 4.11.7 Configurable Channel Parameters

##### ▪ Activate Channel

The users are able to activate/deactivate any channel they desire through this parameter. Each channel has this attribute and as such its status can be manipulated by altering this parameter.

The factory default is “activated” for all channels.

- ***Predefined value***

This parameter is the value set to each channel on power-up of the module. This value is user defined and can be configured for each channel.

- 0 - 22000

The factory default is “0” for this parameter.

- ***Drive on Failsafe Value***

This parameter enables the user to configure a value to be used when communication with the module fails. This value is user defined and can be configured for each channel.

If the configured value is in the nominal range of the module, this value will be output; otherwise, the module will keep previous output unchanged.

- 0 – 22000

The factory default is “0” for all channels.






## 5 Installation, Handling & Storage Considerations

In this chapter are detailed instructions on mounting, installation and cabling of each individual MOX IONITY 603 rack base I/O module. The following items summarize the requirements and should be considered prior to progressing with their installation.

### 5.1 Hazardous Location Information

The modules mentioned in this document are allowed to use in Zone2 (IEC) hazardous locations. These products are marked 'Ex nA II T4 Gc'.

	<ul style="list-style-type: none"> <li>▪ <i>Modules must be installed in an adequate housing to provide IP 54 degree of protection (according to IEC60529) as a minimum. The pollution degrees of the environmental under which the modules are installed can not more than degree 2 (according to IEC60664-1). There must be a manufacturer's declaration for Zone 2 available for the housing (according to the IEC 60079-15). And the following warnings should be stated on the enclosure:</i> <ul style="list-style-type: none"> <li>- <i>DO NOT OPERATE ANY INNER SWITCHES WHEN ENERGIZED.</i></li> <li>- <i>DO NOT SEPARATE ANY CONNECTORS WHEN ENERGIZED.</i></li> </ul> </li> <li>▪ <i>In hazardous area, provisions shall be made to prevent the rated voltage from being exceeded by the transient disturbances of more than 40%.</i></li> <li>▪ <i>In hazardous area, the power consumption for each rack must be under 20W.</i></li> <li>▪ <i>Do not connect or disconnect equipment (no hot-swap) unless power has been removed or the area is known to be non-hazardous.</i></li> <li>▪ <i>Do not connect or disconnect connections to this equipment unless power has been removed or the area is known to be non-hazardous.</i></li> <li>▪ <i>Do not operate the rotary switch located on the front of the I/O module unless power has been removed or the area is known to be non-hazardous.</i></li> <li>▪ <i>Substitution of components may impair suitability for Zone2 (IEC).</i></li> </ul>
---	--

## 5.2 Electrostatic Discharge

Integrated circuits or semiconductors may be severely damaged by electrostatic discharge. This may be caused if the terminal connector pins come in contact with an electrostatically charged object such as hands or clothing. Follow these guidelines when you handle the module.

- Touch a grounded object to discharge static potential.
- Do not touch the terminal connector pins.
- Do not touch circuit components inside the unit.
- Always work with the unit on a grounded surface.

## 5.3 Environmental Precautions

To extend the life of the MOX 603 I/O modules, take the following precautions:

- Store within an ambient temperature range of -40°C to 85°C.
- Store within a relative humidity range of 5% to 90%, non-condensing.
- Avoid storing or operating the device where it could be exposed to a corrosive atmosphere.
- Protect from moisture and direct sunlight.
- Generally operate at an ambient temperature range of -20°C to 55°C. Refer to specific data sheet for details.
- MOX 603 I/O modules have been designed for use in an industrial environment when installed in accordance with these instructions. Within this environment, the equipment is still intended for installation in a clean, dry environment.

## 5.4 Preventing Excessive Heat

For most applications, normal convective cooling keeps the I/O modules within the specified operating range. The following should be considered to ensure that the specified operating range is maintained.

- Recommended spacing between the adjacent racks of I/O modules is 200mm minimum. This prevents much heat influence between the racks, and allows room for wire ducting to be installed without obstructing field wiring installation.
- If particularly high or low ambient temperatures occur, additional cooling or heating provisions should be provided.
- In some applications, a substantial amount of heat is produced by other equipment inside or outside the enclosure. In this case, place blower fans inside the enclosure to assist in air circulation and to reduce “hot spots” near the module.
- Do not bring unfiltered outside air into the enclosure. Place the I/O in an enclosure to protect it from a corrosive atmosphere. Harmful contaminants or dirt could cause improper operation or damage to components. In extreme cases, you may need to use air conditioning to protect against heat build-up within the enclosure.



*It is strongly recommended that the I/O modules are installed upright under severe circumstance in order to ensure the normal convective cooling.*

## 5.5 Installation Cleanliness

During installation and placement of items within the cabinet, do not install any components until all drilling is complete. Also, strip and trim cables well away from the MOX 603 I/O modules. Be sure that debris (metal chips, wire strands, etc.) does not fall into the MOX 603 I/O modules. Such debris could cause damage on power-up. Once wiring is complete, ensure that the unit is free of all metal fragments and other objects that may interfere with correct operation.

## 5.6 Terminal Connectors

Ensure all power sources including the MOX 603 I/O module supply and field I/O supply are isolated from the terminal connector before removing or inserting the terminal connector.



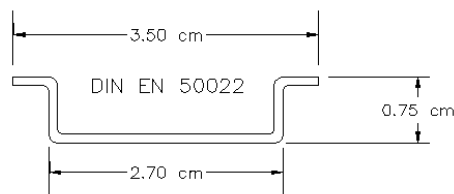
*Always isolate the supply power before removal or insertion of the connector. When you remove or insert the connector with power applied, an electrical arc may occur.*

An electrical arc can cause personal injury or damage to property by:

- Sending an erroneous or excessive signal to your system's field devices
- Causing damage to the product through line spikes
- Cause excessive wear on module contacts due to the electrical arcing
- Create electrical resistance from worn contacts

## 5.7 DIN Rail Specifications

Ensure the DIN rail matches the dimensions of DIN EN 50022 provided as follows.



**Figure 50**      **DIN Rail EN 50022**

The spacing of the adjacently installed DIN rail in a cabinet must be great enough to secure minimum 200mm vertical spacing of I/O modules mounted.



*End brackets are required for each end of DIN rail, to eliminate sparks caused by loose connection between rack bases of I/O.*

## 5.8 Cable Path Considerations

When installing communications cables, the path of the cables should be planned to avoid electrical interference. Follow these guidelines to reduce electrical interference:

- Keep the communication cable at least 1.52m from any electric motors, transformers, rectifiers, generators, arc welders, induction furnaces, or sources of microwave radiation.
- If you must run the cable across power feed lines, run the cable at right angles to the lines.
- If you do not run the cable through a contiguous metallic wire way or conduit, keep the communication cable at least 150mm from AC power lines of less than 20A, 300mm from lines greater than 20A, but only up to 100kVA, and 600mm from lines of 100kVA or more.
- If you run the cable through a contiguous metallic wire way or conduit, keep the communication cable at least 80mm from AC power lines of less than 20A, 150mm from lines greater than 20A (but only up to 100kVA), and 300mm from lines of 100kVA or more.

Running the communication cable through conduit provides extra protection from physical damage and electrical interference. If you route the cable through conduit, follow these additional recommendations:

- Use ferromagnetic conduit near critical sources of electrical interference. You can use aluminum conduit in non-critical areas.
- Use plastic connectors to couple between aluminum and ferromagnetic conduit. Make an electrical connection around the plastic connector (use pipe clamps and the heavy gauge wire or wire braid) to hold both sections at the same potential.
- Ground the entire length of conduit by attaching it to the building earth ground.
- Do not let the conduit touch the plug on the cable.
- Arrange the cables loosely within the conduit. The conduit should contain only serial communication cables.
- Install the conduit so that it meets all applicable codes and environmental specifications.

### 5.8.1 *Minimizing Electrical Noise on Analog Signal Lines*

Analog input channels employ digital high frequency filters that significantly reduce the effects of electrical noise on input signals. However, because of the variety of applications and environments where analog controllers are installed and operating, it is impossible to ensure that the input filters will remove all environmental noise. Several specific steps can be taken to help reduce the effects of environmental noise on analog signals:

- Install the MOX 603 I/O system in a properly rated (i.e. NEMA) enclosure.
- Make sure that the MOX 603 I/O system is properly grounded.
- Use Belden cable #8761 for wiring the analog channels making sure that the drain wire and foil shield are properly earth grounded at one end of the cable.
- Route the Belden cable separate from any other wiring. Additional noise immunity can be obtained by routing the cables in grounded conduit.
- Periodically check the system operation, particularly when new machinery or other noise sources are installed near the system.

### **5.8.2     *Analog Signal Cable Grounding***

Use shielded communication cable (Belden #8761). The Belden cable has two signal wires (black and clear), one drain wire and a foil shield. The drain wire and foil shield must be grounded at one end of the cable. We recommend grounding the shield to the case of the signal source, so energy coupled to the shield will not be delivered to signal source's electronics.



*Do not ground the drain wire and foil shield at both ends of the cable.*

### **5.8.3     *High Speed Counter Cable Grounding***

We recommend shielded cable be used for high-speed counter input signals. We recommend Belden #9503 or equivalent for lengths up to 300m. Shields should be grounded only at the signal source end of the cable.

## 5.9 Power

### 5.9.1 Power Requirements

MOX IONITY 603 rack base I/O modules in the rack-base configuration require a 5VDC voltage from the base and are supplied by the MOX 603 PSU. The MOX 603 PSU accepts 24VDC and converts this to +5VDC to power the racked I/O modules via the module bases.

It may be more convenient to supply all of the devices in the same enclosure with a single power supply. However, this is not essential.

Applying an incorrect voltage to any of the MOX 603 I/O module may cause damage. Connect the mains power to the user supplied DC Power Supply Unit only.

Ensure your power supply is sufficiently sized to suit the power requirements of your system. Ensure the power supply has adequate output capacity to supply all of the connected devices.

To calculate the current requirements, add the wattage required for the 603 I/O modules in use, divide the total wattage by the DC power source voltage.



*To avoid electric shock or damage, power should only be applied after all wiring terminations are complete.*

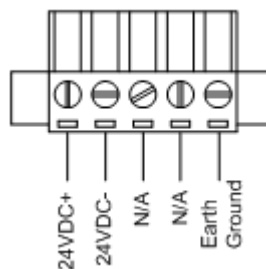
### 5.9.2 Power Isolation

When removing power from the device, interruption of the DC side of the power supply is preferred. This avoids the additional discharge delay of the power supply if the AC line is connected.

Always fuse the AC line of the power supply and place the main power isolation switch where operators and maintenance personnel have quick and easy access to it. If you mount an isolation switch inside the controller enclosure, place a handle on the outside of the enclosure to switch the isolator, so that you can disconnect power without opening the enclosure.

### 5.9.3 DC Power Wiring (User DC Source)

Make sure a good wiring (minimum AWG18) is connected to the '24VDC+', '24VDC-' and 'Earth Ground' terminals on the PSU base. The cable shall be connected to a grounding conductor with a cross-sectional area of at least 4 mm<sup>2</sup>.



In hazardous area, provisions shall be made to prevent the rated voltage from being exceeded by the transient disturbances of more than 40%.



### 5.9.4 Applying Power

After all field wiring is installed, power up all 603 I/O module and related peripherals. Observe the status LED on each of the 603 I/O modules. Normal 603 I/O modules start-up conditions will result in the following.

- 1) The power LED (PWR) will turn to the ON state, indicating that the unit is receiving a valid power input.
- 2) The MOX 603 I/O modules status LED (STA) will first switch on for a short period of time then turn off again. After another short period of time it will turn to and remain in the ON state, indicating that the Operating System within the unit is functional and awaiting either communication requests or an update of inputs/outputs.

## 5.10 Recommended Operating Tools

For front-wiring I/O modules, the terminal strips are provided for wiring the field signals to the module. They are of three different kinds: 18-pin, 8-pin and 12-pin. For the first two, the pin spacing is 3.5mm. For the last one, the pin spacing is 2.5mm. Please refer to the following table for details:

Part Number	Module Description	Pin Spacing (mm)
MX603-5132-133	32 DI Dry Contact Front-wiring	2.5
MX603-5232-123	32 DO 24VDC Module Power Front-wiring	2.5
MX603-5612-923	12 RTD Front-wiring	2.5
MX603-5116-273	16 DI Dry Contact Front-wiring	3.5
MX603-5312-113	12 AI 4-20mA Front-wiring	3.5
MX603-5312-123	12 AI 1-5VDC Front-wiring	3.5
MX603-5312-133	12 AI 4-20mA Front-wiring	3.5
MX603-5512-823	12 TC Front-wiring	3.5
MX603-5408-123	8 AO 4-20mA Isolated Module Power Front-wiring	3.5
MX603-5108-173	8 CNT Front-wiring	3.5
MX603-5112-143	12 SOE Front-wiring	3.5

Table 39 Pin Spacing for Front-wiring I/O Modules

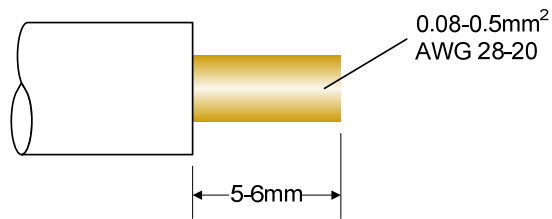
2.5mm:

For terminal strips with 2.5mm pin spacing, a special screwdriver with insulated shaft is particularly appropriate for their easy operation. The part number of this operating tool is 603-00-16505. The following figure shows the appearance of the screwdriver:



Figure 51 Screwdriver for 2.5mm Pin Spacing Terminal Strips

It is recommended to adopt wires of following specifications:



**Figure 52 Wire Specifications for 2.5mm Pin Spacing Terminal Strips**

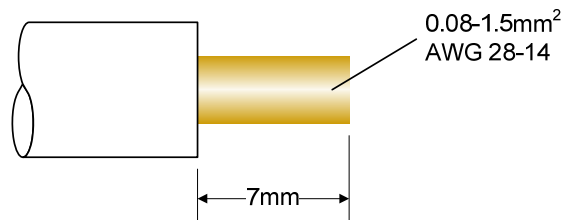
3.5mm:

For terminal strips with 3.5mm pin spacing, the following screwdriver is recommended to operate the connector correctly. Its part number is 603-00-16511.



**Figure 53 Screwdriver for 3.5mm Pin Spacing Terminal Strips**

It is recommended to adopt wires of following specifications:



**Figure 54 Wire Specifications for 3.5mm Pin Spacing Terminal Strips**

To use these two recommended tools properly, you should insert the screwdriver into the bottom of the connector to flick the corresponding tole. Then insert the wires into the hole of the tole and pull up the screwdriver from the connector. In this way, the wires can be firmly locked.

## 6 A Typical System

A typical IONITY system consists of IoNix Processor and rack-base I/O modules. Please refer to the figure below:



IoNix

Figure 55

I/O Modules

Example MOX IONITY System

For further information on configuration of the MOX IoNix Processor, please refer to the MOX IONITY System User Guide.

## Appendix A Product Support

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### Warranty Information

All MOX manufactured products are warranted to be free from defects in material and workmanship. Our obligation under this warranty will be limited to repairing or replacing, at our option, the defective parts within 1 year of the date of installation, or within 18 months of the date of shipment from the point of manufacture, whichever is sooner. Products may only be returned under authorization. The purchaser will prepay all freight charges to return any products with a valid return authorization number to the designated repair facility.

This limited warranty does not cover loss or damage that may occur in shipment of the goods or due to improper installation, maintenance, misuse, neglect or any cause other than ordinary commercial or industrial use. Warranty is also void if case is opened without manufacturer's consent. This limited warranty is in lieu of all other warranties whether oral or written, expressed or implied.

Liability associated with all MOX products shall not exceed the price of the individual unit that is the basis of the claim. In no event will there be liability for any loss of profits, loss of use of facilities or equipment or other indirect, incidental or consequential damages.

### Contact Details

To obtain support for MOX products, call MOX Group on the following numbers or your designated support provider and ask for MOX Support.

### E-mail Addresses:

[support@mox.com.au](mailto:support@mox.com.au)

[sales@mox.com.au](mailto:sales@mox.com.au)

### Visit our web page at:

<http://www.mox.com.au>



## Service Information

If you require service, contact your local MOX Group representative. A trained specialist will help you to quickly determine the source of the problem. Many problems are easily resolved with a single phone call. If it is necessary to return a unit, an RMA (Return Material Authorization) number will be provided.

All returned materials are tracked with our RMA system to ensure speedy service. You must include this RMA number on the outside of the box so that your return can be processed immediately.

Your MOX Group authorized applications engineer will complete an RMA request for you. If the unit has a serial number, we will not need detailed financial information. Otherwise, be sure to have your original purchase order number and date purchased available.

We suggest that you provide a repair purchase order number in case the repair is not covered under our warranty. You will not be billed if the repair is covered under warranty.

Please supply us with as many details about the problem as you can. The information you supply will be written on the RMA form and supplied to the repair department before your unit arrives. This helps us to provide you with the best service, in the fastest manner. Most repairs are completed within two days. During busy periods, there may be a longer delay.

If you need a quicker turnaround, ship the unit to us by airfreight. We give priority service to equipment that arrives by overnight delivery. Many repairs received by midmorning (typical overnight delivery) can be finished the same day and returned immediately.

We apologize for any inconvenience that the need for repair may cause you. We hope that our rapid service meets your needs. If you have any suggestions to help us improve our service, please give us a call. We appreciate your ideas and will respond to them.

## For Your Convenience:

Please fill in the following information and keep this manual with your MOX system for future reference:

P.O. #: \_\_\_\_\_ Date Purchased: \_\_\_\_\_

Purchased From: \_\_\_\_\_



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