# USER MANUAL

## Z-5DI2-DO

### 5 DIGITAL INPUT/COUNTERS AND 2 DIGITAL RELAYS OUTPUT WITH USB / RS485 PORT AND MODBUS RTU PROTOCOL




CE

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**ORIGINAL INSTRUCTIONS**

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# Introduction

The content of the present documentation refers to products and technologies described in it.
All technical data contained in the document may be modified without prior notice.
The content of this documentation is subject to periodical revision.
To use the product safely and effectively, read carefully the following instructions before use.
The product must be used only for the use for which it was designed and built: any other use must be considered with the user's full responsibility.
The installation, programming and set-up is allowed only to authorized operators, physically and intellectually suitable.
Set up shall be performed only after a correct installation and the user shall perform every operation described in the installation manual carefully.
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# Document revisions

| DATE | REVISION | NOTES |
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| 11/05/2018 | 1.0.0.0 | First Release |
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# 1. DEVICE DESCRIPTION AND INTENDED USE

**⚠ WARNING!**

**This User Manual extends the information about the device configuration in the Installation Manual. Use the Installation Manual for more info.**

**⚠ WARNING!**

**Under no circumstances, SENECA s.r.l. or its suppliers shall be responsible for loss of recording data/income or for consequential or incidental damage due to neglect or reckless mishandling of the device, even though SENECA is well aware of these possible damages.**
**SENECA, its subsidiaries, affiliates, companies of the group, suppliers and retailers shall not guarantee that the functions will satisfy completely customer's expectations or that the device, firmware and software shall have no errors or work continuously.**

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## 1.1. Description

The Z-5DI-2DO module acquires 5 single-ended digital signals, then converts them to a digital format (IN 1-5 state). No. 2 Relay Outputs are also available and can be written from the Modbus RTU Protocol.
The supported communication protocol is Modbus RTU.
The following counters are available:
5 32-bit counters in non-volatile memory (Fe-RAM memory for infinite writing)
5 Frequency/Ton/Toff/Period
An RS485 port with a standard Modbus RTU protocol is also available.

## 1.2. Features

- No. 5 opto-insulation digital inputs with a common contact. Internal or external, NPN (sink) or PNP (source) selectable by software.
- Insulation of the 1500 Vac inputs complying the remaining low voltage circuits.
- No. 2 SPST relay outputs with common contact, capacity of 2 AAC1 250 Vac.
- 3 kVac insulation between the outputs and the remaining low voltage circuits.
- Inputs with 32-bit totalizers, max frequency 5 KHz.
- Measurement of the period, frequency, TON, TOFF. Max frequency 5KHz.
- Possibility to set the totalizers to count forward or backward
- All the totalizers are saved in a non-volatile memory (Fe-RAM).
- RS485 and USB serial communication with Modbus-RTU protocol, RS485 with 64 nodes maximum (without repeater). Configurable also via dip-switch.
- Communication times shorter than 10 ms (@ 38400 Baud).
- Connection distance up to 1200 m.
- Facilitated wiring of power supply and serial connection by means of a bus which can be housed in the DIN guide.
- Module can be fitted on and removed from bus without interrupting communication or power supply to the system.
- Input Counters IN1-IN5 can be filtered
- Free Easy Setup software for configuration
- Baud rate for Modbus RTU: from 2400 baud up to 115200 baud
- Quick installation on DIN 46277 rail

Refer to the installation manual for more information.

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# 2. OUTPUT CONFIGURATION

## 2.1. Configure Outputs as NO or NC

To configure the outputs as Normally Open or Normally Closed mode use the J1, J2 jampers:

J1 controls Output1 and J2 Output2, to obtain a NO / NC configuration the jamper must be connected this way:




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# 3. DIP SWITCH CONFIGURATION (SW1)

The dip switches can be used to configure the Baud Rate and the Modbus Station Address.
DIP 1 and 2 are used for the RS485 port baud rate
DIP 3 to 8 are used for the RS485 port ModBus station address
DIP 9 is not used
DIP 10 is used to insert an R-C terminal in the RS485 port

## 3.1. Loading configuration for RS485 port from flash

If ALL Dip Switches 1…8 are OFF, the device uses the Flash configuration (you must use the Easy Setup Software to configure the Modbus parameters)

| *Load RS485 port Configuration* | *DIP1* | *DIP2* | *DIP3* | *DIP4* | *DIP5* | *DIP6* | *DIP7* | *DIP8* |
|---|---|---|---|---|---|---|---|---|
| FROM FLASH | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF |

**⚠ WARNING!**
**Dip switch configuration is active only after a reboot!**

**⚠ WARNING!**
**The Dip Switch setting will overwrite the Flash setting so, if you need to use the flash configuration you MUST set ALL dip switches to "OFF".**

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## 3.2. Setting the RS485 Port Baud rate

Dip Switch 1 and 2 are used for setting the Baud Rate

| *Baud Rate* | *DIP1* | *DIP2* |
|---|---|---|
| 9600 | OFF | OFF |
| 19200 | OFF | ON |
| 38400 | ON | OFF |
| 57600 | ON | ON |

**⚠ WARNING!**

**The Parity bit and the Stop bits cannot be configured with the dip switch configuration but only using the Easy Setup software. By setting the dip switches the parity is always set to "None" and the Stop Bits to 1: (8,N,1).**

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## 3.3. Setting the RS485 Port Modbus Station Address

Dip Switch 3 to 8 are used to configure the RS485 Port Station Address using the binary convention:

| *Modbus Station Address* | *DIP3* | *DIP4* | *DIP5* | *DIP6* | *DIP7* | *DIP8* |
|---|---|---|---|---|---|---|
| 1 | OFF | OFF | OFF | OFF | OFF | ON |
| 2 | OFF | OFF | OFF | OFF | ON | OFF |
| 3 | OFF | OFF | OFF | OFF | ON | ON |
| 4 | OFF | OFF | OFF | ON | OFF | OFF |
| 5 | OFF | OFF | OFF | ON | OFF | ON |
| 6 | OFF | OFF | OFF | ON | ON | OFF |
| 7 | OFF | OFF | OFF | ON | ON | ON |
| 8 | OFF | OFF | ON | OFF | OFF | OFF |
| 9 | OFF | OFF | ON | OFF | OFF | ON |
| 10 | OFF | OFF | ON | OFF | ON | OFF |
| 11 | OFF | OFF | ON | OFF | ON | ON |
| 12 | OFF | OFF | ON | ON | OFF | OFF |
| 13 | OFF | OFF | ON | ON | OFF | ON |
| 14 | OFF | OFF | ON | ON | ON | OFF |
| 15 | OFF | OFF | ON | ON | ON | ON |
| … | … | … | … | … | … | … |
| 63 | ON | ON | ON | ON | ON | ON |

## 3.4. Setting the RS485 TERMINATOR

The dip switch 10 activates the R-C Terminator:

| *Terminator* | *DIP9* | *DIP10* |
|---|---|---|
| OFF | Not Used | OFF |
| ON | Not Used | ON |

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# 4. USB PORT

The USB port uses the following fixed configuration:

Protocol: Modbus RTU Slave
Modbus Station Address: 1
Baud rate: 38400 baud
Data Bit: 8
Parity: None
Stop Bits: 1

**⚠ WARNING!**
**The USB Port configuration is fixed and is not affected by dip switches or flash configuration**

**⚠ WARNING!**
**When the USB port is connected the RS485 Port is deactivated.**
**When the USB Port is disconnected the RS485 Port is activated.**
**Therefore it is not possible to use the RS485 Port simultaneously with the USB Port**

## 4.1. USB Virtual COM Port Drivers

The Windows Drivers is included in the Easy Setup, drivers for others operating systems can be downloaded from:

http://www.ftdichip.com/Drivers/VCP.htm

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# 5. MODBUS RTU PROTOCOL

The Modbus protocol supported by the Z-5DI-2DO by RS485 and USB ports is:

- Modbus RTU Slave

For more information about this protocol, please refer to the Modbus specification website:

http://www.modbus.org/specs.php.

## 5.1. Supported Modbus RTU function code

The following Modbus RTU functions are supported:

- Read Holding Register (function code 3) Max 28 Registers
- Write Single Register (function code 6)
- Write Multiple registers (function code 16) Max 10 Registers
- Read Coil Registers (function code 1) Max 7 Registers
- Write Single Coil (function code 5)
- Read Inputs (function code 2) Max 7 Registers

**⚠ WARNING!**
**All 32 bit values are stored into 2 consecutive registers**

**⚠ WARNING!**
**You can read a maximum of 28 Modbus Registers with the Read Holding Register function (function code 3)**

**⚠ WARNING!**
**You can write a maximum of 10 Modbus Registers with the Write Multiple Register function (function code 16)**

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# 6. MODBUS REGISTERS TABLE

In the following table these abbreviations are used:

| |
|---|
| MS = Most significant |
| LS = Less significant |
| MSW = Most significant word (16 bits) |
| LSW = Least significant word (16 bits) |
| R = Read only register |
| RW = Read and writeable register |
| RW* = Read and writeable register, the value can be stored in flash by using the store flash command |
| Unsigned 16 bits = Unsigned 16-bit register (from 0 to 65535) |
| Signed 16 bits = 16-bit register with sign (from -32768 to +32767) |
| Float 32 bits = Floating point single precision 32-bit (IEEE 754) register |
| 0x = Hexadecimal Value |

## 6.1. Bit Position Convention in the Holding Registers:

One Holding Register consists of 16 bits with the following convention:

| BIT 15 | BIT 14 | BIT 13 | BIT 12 | BIT 11 | BIT 10 | BIT 9 | BIT 8 | BIT 7 | BIT 6 | BIT 5 | BIT 4 | BIT 3 | BIT 2 | BIT 1 | BIT 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

For example, if the register value in decimal is
12300
the 12300 value in hexadecimal is:
0x300C
the 0x300C hexadecimal in binary value is:
0011 0000 0000 1100
So, using the Bit convention we obtain:

| BIT 15 | BIT 14 | BIT 13 | BIT 12 | BIT 11 | BIT 10 | BIT 9 | BIT 8 | BIT 7 | BIT 6 | BIT 5 | BIT 4 | BIT 3 | BIT 2 | BIT 1 | BIT 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |

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## 6.2. Modbus Holding Registers Addresses (function code 3):

| Register Name | Comment | Register Type | R/W | Default value or Start Value | Modbus Address | Register Offset |
|---|---|---|---|---|---|---|
| **Machine ID** | Module ID code | Unsigned 16 bits | R | - | 40001 | 0 |
| **Firmware Revision** | Firmware Revision Code | Unsigned 16 bits | R | - | 40002 | 1 |
| **AUX 4** | Parameter register for Command | Unsigned 16 bits | R/W | - | 40003 | 2 |
| **AUX 3** | Parameter register for Command | Unsigned 16 bits | R/W | - | 40004 | 3 |
| **AUX 2** | Parameter register for Command | Unsigned 16 bits | R/W | - | 40005 | 4 |
| **AUX 1** | Parameter register for Command | Unsigned 16 bits | R/W | - | 40006 | 5 |
| **Command** | This register is used for sending commands to the device.<br>The following commands are supported:<br>49600<br>Store configuration in Flash<br>49568<br>Reset the Module<br>49601<br>Load Default parameters<br>After the command is executed the register will return to 0 value | Unsigned 16 bits | R/W | 0 | 40007 | 6 |
| **Fail Config** | Bit 0 = 0 Outputs Fail Control Disabled<br>Bit 0 = 1 Outputs Fail Control Enabled<br>Bit 1 = Output1 value in fail ( 0 = not energized, 1 = energized)<br>Bit 2 = Output2 value in fail ( 0 = not energized, 1 = energized)<br>Bit 3 .. Bit 15 Not used | Unsigned 16 bits | R/W* | 0 | 40008 | 7 |

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| | | | | | | |
|---|---|---|---|---|---|---|
| **Fail Delay [seconds]** | Number of seconds after that, if there is no Modbus communication, the outputs go in fail mode.<br>From 1 to 250 seconds | Unsigned 16 bits | R/W* | 30 | 40009 | 8 |
| **Serial/Din Config** | Bit 0..Bit 5 Not used<br>Bit 6 = 0 Parity Disabled<br>Bit 6 = 1 Parity Enabled<br>Bit 7 = 0 Parity Odd<br>Bit 7 = 1 Parity Even<br>Bit 8 = 0 1 Stop Bit<br>Bit 8 = 1 2 Stop Bit<br>Bit 9…Bit 14 Not Used<br>Bit 15 = 0 Din in PNP (Source) mode<br>Bit 15 = 1 Din in NPN (Sink) mode | Unsigned 16 bits | R/W* | 0 | 40010 | 9 |
| **Modbus Station Address** | Modbus RTU station address | Unsigned 16 bits | RW* | 1 | 40011 | 10 |
| **Baud Rate** | RS485 Port Baud rate<br>0 = 4800 baud<br>1 = 9600 baud<br>2 = 19200 baud<br>3 = 38400 baud<br>4 = 57600 baud<br>5 = 115200 baud<br>6 = 2400 baud | Unsigned 16 bits | RW* | 3 | 40012 | 11 |
| **Counters/Measures Filter [ms*10]** | Filter to be used for Counters / Period / Frequency / TON / TOFF<br>cutoff frequency [Hz] =10000/Filter Value<br>For example:<br>200 means:<br>Freq cut= 10000/200 = 50 Hz<br>Values from 0 (filter Disabled) to 250 | Unsigned 16 bits | RW* | 0 | 40013 | 12 |
| **Up/Down Counter** | Bit 0 = 0 Counter 1 in upcounter mode<br>Bit 0 = 1 Counter 1 in downcounter mode<br>Bit 1 = 0 Counter 2 in upcounter mode<br>Bit 1 = 1 Counter 2 in downcounter mode<br>Bit 2 = 0 Counter 3 in upcounter mode | Unsigned 16 bits | RW* | 0 | 40014 | 13 |

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| | | | | | | |
|---|---|---|---|---|---|---|
| | Bit 2 = 1 Counter 3 in downcounter mode<br>Bit 3 = 0 Counter 4 in upcounter mode<br>Bit 3 = 1 Counter 4 in downcounter mode<br>Bit 4 = 0 Counter 5 in upcounter mode<br>Bit 4 = 1 Counter 5 in downcounter mode | | | | | |
| **Inputs Value / Output Fail** | Bit 0 = 0 input 1 Low<br>Bit 0 = 1 input 1 High<br>Bit 1 = 0 input 2 Low<br>Bit 1 = 1 input 2 High<br>Bit 2 = 0 input 3 Low<br>Bit 2 = 1 input 3 High<br>Bit 3 = 0 input 4 Low<br>Bit 3 = 1 input 4 High<br>Bit 4 = 0 input 5 Low<br>Bit 4 = 1 input 5 High<br>Bit 5..6 Not Used<br>Bit 7 = 0 Outputs Status OK<br>Bit 7 = 0 Outputs Status FAIL | Unsigned 16 bits | R | 0 | 40015 | 14 |
| **Outputs Value** | Bit 0 = 0 Output Relay 1 not energized<br>Bit 0 = 1 Output Relay 1 energized<br>Bit 1 = 0 Output Relay 2 not energized<br>Bit 1 = 1 Output Relay 2 energized | Unsigned 16 bits | R/W | 0 | 40016 | 15 |
| **Counter 1 Value** | Input 1 Counter Value | Unsigned 32 bits | R/W (Backupped in FeRAM memory) | 0 | 40101 MSW 40102 LSW | 100 MSW 101 LSW |
| **Counter 2 Value** | Input 2 Counter Value | Unsigned 32 bits | R/W (Backupped in FeRAM memory) | 0 | 40103 MSW 40104 LSW | 102 MSW 103 LSW |
| **Counter 3 Value** | Input 3 Counter Value | Unsigned 32 bits | R/W (Backupped in FeRAM memory) | 0 | 40105 MSW 40106 LSW | 104 MSW 105 LSW |

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| | | | | | | |
|---|---|---|---|---|---|---|
| **Counter 4 Value** | Input 4 Counter Value | Unsigned 32 bits | R/W (Backupped in FeRAM memory) | 0 | 40107 MSW 40108 LSW | 106 MSW 107 LSW |
| **Counter 5 Value** | Input 5 Counter Value | Unsigned 32 bits | R/W (Backupped in FeRAM memory) | 0 | 40109 MSW 40110 LSW | 108 MSW 109 LSW |
| **Period 1** | Input 1 Period [x100us] (for example 10 = 1ms) From firmware version 1.0.1.2: Input 1 Period [x1ms] | Unsigned 16 bits | R | 0 | 40121 | 120 |
| **Period 2** | Input 2 Period [x100 us] (for example 10 = 1ms) From firmware version 1.0.1.2: Input 2 Period [x1ms] | Unsigned 16 bits | R | 0 | 40122 | 121 |
| **Period 3** | Input 3 Period [x100us] (for example 10 = 1ms) From firmware version 1.0.1.2: Input 3 Period [x100us] | Unsigned 16 bits | R | 0 | 40123 | 122 |
| **Period 4** | Input 4 Period [x100 us] (for example 10 = 1ms) From firmware version 1.0.1.2: Input 4 Period [x1ms] | Unsigned 16 bits | R | 0 | 40124 | 123 |
| **Period 5** | Input 5 Period [x100 us] (for example 10 = 1ms) From firmware version 1.0.1.2: Input 5 Period [x1ms] | Unsigned 16 bits | R | 0 | 40125 | 124 |
| **Frequency 1** | Input 1 Frequency [Hz] | Unsigned 16 bits | R | 0 | 40131 | 130 |
| **Frequency 2** | Input 2 Frequency [Hz] | Unsigned 16 bits | R | 0 | 40132 | 131 |
| **Frequency 3** | Input 3 Frequency [Hz] | Unsigned 16 bits | R | 0 | 40133 | 132 |
| **Frequency 4** | Input 4 Frequency [Hz] | Unsigned 16 bits | R | 0 | 40134 | 133 |
| **Frequency 5** | Input 5 Frequency [Hz] | Unsigned 16 bits | R | 0 | 40135 | 134 |
| **T high 1** | Input 1 Ton [x100 us] (for example 10 = 1ms) From firmware version 1.0.1.2: Input 1 Ton [x1ms] | Unsigned 16 bits | R | 0 | 40141 | 140 |
| **T high 2** | Input 2 Ton [x100 us] (for example 10 = 1ms) | Unsigned 16 bits | R | 0 | 40142 | 141 |

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| | | | | | | |
|---|---|---|---|---|---|---|
| | From firmware version 1.0.1.2:<br>Input 2 Ton [x1ms] | | | | | |
| **T high 3** | Input 3 Ton [x100 us]<br>(for example 10 = 1ms)<br>From firmware version 1.0.1.2:<br>Input 3 Ton [x1ms] | Unsigned<br>16 bits | R | 0 | 40143 | 142 |
| **T high 4** | Input 4 Ton [x100 us]<br>(for example 10 = 1ms)<br>From firmware version 1.0.1.2:<br>Input 4 Ton [x1ms] | Unsigned<br>16 bits | R | 0 | 40144 | 143 |
| **T high 5** | Input 5 Ton [x100 us]<br>(for example 10 = 1ms)<br>From firmware version 1.0.1.2:<br>Input 5 Ton [x1ms] | Unsigned<br>16 bits | R | 0 | 40145 | 144 |
| **T low 1** | Input 1 Toff [x100 us]<br>(for example 10 = 1ms)<br>From firmware version 1.0.1.2:<br>Input 1 Toff [x1ms] | Unsigned<br>16 bits | R | 0 | 40151 | 150 |
| **T low 2** | Input 2 Toff [x100 us]<br>(for example 10 = 1ms)<br>From firmware version 1.0.1.2:<br>Input 2 Toff [x1ms] | Unsigned<br>16 bits | R | 0 | 40152 | 151 |
| **T low 3** | Input 3 Toff [x100 us]<br>(for example 10 = 1ms)<br>From firmware version 1.0.1.2:<br>Input 3 Toff [x1ms] | Unsigned<br>16 bits | R | 0 | 40153 | 152 |
| **T low 4** | Input 4 Toff [x100 us]<br>(for example 10 = 1ms)<br>From firmware version 1.0.1.2:<br>Input 4 Toff [x1ms] | Unsigned<br>16 bits | R | 0 | 40154 | 153 |
| **T low 5** | Input 5 Toff [x100 us]<br>(for example 10 = 1ms)<br>From firmware version 1.0.1.2:<br>Input 5 Toff [x1ms] | Unsigned<br>16 bits | R | 0 | 40155 | 154 |

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## 6.3. Modbus Coil Registers Addresses (function code 1):

| Register Name | Comment | Register Type | R/W | Default value or Start Value | Modbus Address | Register Offset |
|---|---|---|---|---|---|---|
| **Input 1** | Input 1 Value | Bit | R | 0 | 1 | 0 |
| **Input 2** | Input 2 Value | Bit | R | 0 | 2 | 1 |
| **Input 3** | Input 3 Value | Bit | R | 0 | 3 | 2 |
| **Input 4** | Input 4 Value | Bit | R | 0 | 4 | 3 |
| **Input 5** | Input 5 Value | Bit | R | 0 | 5 | 4 |
| **Output 1** | Output 1 Value | Bit | R/W | 0 | 6 | 5 |
| **Output 2** | Output 2 Value | Bit | R/W | 0 | 7 | 6 |

## 6.4. Modbus Input Registers (read only) Addresses (function code 2):

| Register Name | Comment | Register Type | R/W | Default value or Start Value | Modbus Address | Register Offset |
|---|---|---|---|---|---|---|
| **Input 1** | Input 1 Value | Bit | R | 0 | 10001 | 0 |
| **Input 2** | Input 2 Value | Bit | R | 0 | 10002 | 1 |
| **Input 3** | Input 3 Value | Bit | R | 0 | 10003 | 2 |
| **Input 4** | Input 4 Value | Bit | R | 0 | 10004 | 3 |
| **Input 5** | Input 5 Value | Bit | R | 0 | 10005 | 4 |
| **Output 1** | Output 1 Value | Bit | R | 0 | 10006 | 5 |
| **Output 2** | Output 2 Value | Bit | R | 0 | 10007 | 6 |

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