7bit Synapse

MQTT/Modbus TCP/8DI/8DO(R)/32x1-Wire/AC

Industrial digital input/output module for remote process control and data acquisition

Thank you for choosing our product. The 7bit Synapse module designed as a remote Ethernet DIO, counter and 1-Wire temperature input module for industrial automation and monitoring applications. MQTT connectivity option allows you to create cloud-based monitoring & control applications. Built-in AC power supply and 2-port Ethernet switch simplify installation and cabling, extending network length and allowing to install the module into existing network w/o extra equipment. The setup is made easy with the web-config page.

Module Synapse is an OPEN-TYPE device. It should be installed in a control cabinet free of airborne dust, humidity, electric shock and vibration

The device is operating at dangerous voltage rating. High voltage also may occur at output terminals during it work. Please do not touch these terminals when the device is powered on. DO NOT connect AC power to any of input terminals, otherwise serious damage may occur. Please double check all wiring before Synapse is getting powered up

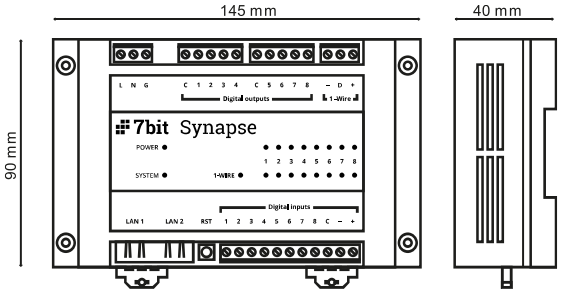
The following abbreviations are used for Modbus registers functions: C - **C**oils, DI - **D**igital Inputs, HR/IR – **H**olding/**I**nput Registers, and their data format: W - **W**ord (2 bytes), DW - **D**ouble Word, b – **b**it. R/W – **R**ead/**W**rite mode.

1. Technical specifications

Power supply	100 - 220 VAC, 50/60 Hz, Max power consumption: 3W
Communication	2 x Fast Ethernet switch, Modbus TCP, MQTT
INPUTS	
Points	8 x DI with single common, Isolation voltage 5000 Vac / 500 Vdc, 12 - 24 AWG
Type	24 VDC (SINK / SOURCE) or internal isolated DC supply
Counters & Time on totalizers	8 + 8 / 8 + 8 (for each DI & DO channel), 32-bit capacity, static memory, 1 kHz max. sw. frequency
Jitter filter	Individual for each channel, adj. 0 ~ 20ms (default 20ms)
OUTPUTS	
Points	8xDO, 12 - 24 AWG, two groups DO 1 - 4 and DO 5 - 8 (SSR or Relay or SSR + Relay)
Relay	220 VAC / 30 VDC, 2A. Max. frequency: 1 Hz, ~10 ms response time
SSRs*	AC, 85 - 220V 2A, Zero-crossing switching. Max. frequency: 100 Hz
1WIRE	
Points	Up to 32 digital thermometers DS18B20
Bus length	Up to 200 m.
ENVIRONMENTAL	
Operation - Storage / Protection	0°C - 55°C, 5 - 90% (w/o condensation), -25°C - 70°C, 5 - 95% IP40
Weight	200 g.

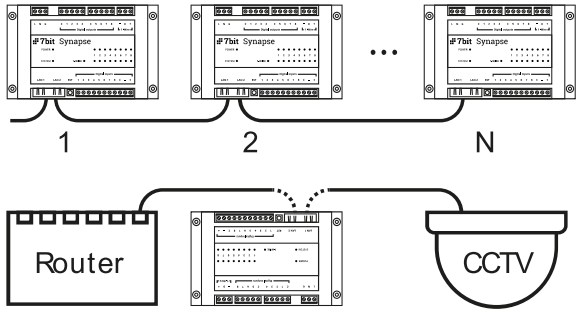
* made by order

2. Dimensional drawing

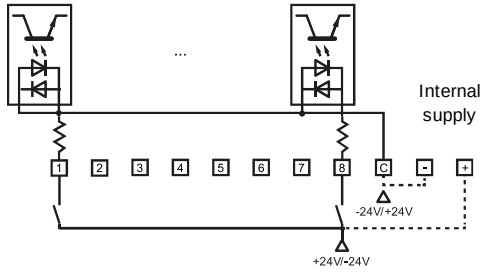


3. Wiring

3.1 Ethernet. Synapse has an embedded switch which make easy to connect numerous modules simply, connecting them to each other in "daisy chain". As it is true Ethernet witch, each connection may be up to 100 m. It is also possible to connect the device at any breaking of existing Ethernet link.



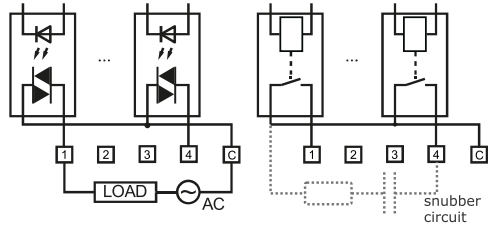
3.2 Digital inputs



Address	Description	Data	R/W	Default
DI0 ~ DI7	Digital Inputs	b	R	-
HR20 ~ HR27	Input filters (0 - disabled)	W	R/W	20

Use internal power supply for powering inputs via long cables with caution due to low voltage and voltage drop you may have unstable DI signaling

3.3 Digital outputs There are 2 groups by 4 outputs, each can be either relay or SSR (by order) type. Due to Zero-cross detection unit, SSR provides comfort switching for any AC load in the range 85 - 220V, 2A. Relay outputs is commonly used for dry contacts and DC signals commutation.



Address	Description	Data	R/W	Default
C0 ~ C7	Digital outputs	b	R/W	-

To avoid sparks, limit switching currents and increase switching lifetime for the outputs, it is strongly recommended to use extra snubber circuits for inductive loads.

3.4 Safe power on After power on the module can restore its outputs to a previous state. For many applications it is convenient feature, but for some not. E.g. some parts of a heavy machine may accidentally move on repower and cause dangerous situation. To avoid this problem now there is a special setting to choose output state after repower:

Address	Description	Data	R/W	Default
HR35	Safety state 0 – off, 1 - on	W	R/W	0 (off)

3.5 PWM for triac outputs The duty cycle is set as 0 .. 100 which means how many periods of AC current from one hundred will power the load. So the time base of the PWM is 100 * 20 ms (1/50Hz) = 2 seconds. Before using DO for common ON – OFF control set PWM values to 0.

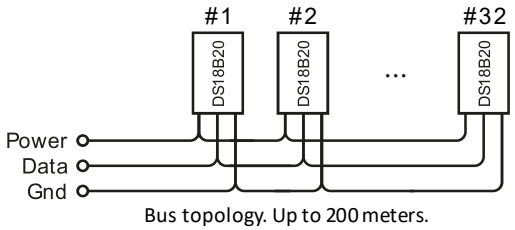
Address	Description	Data	R/W	Default
HR111 ~ 118	DO1 ~ 8 PWM duty cycle	W	R/W	0 (No)

3.6 Predictive maintenance functions (changeover & time on counters)

Power on cycles and run hours may reduce life-time of the equipment under monitor. Now it is possible to count them using Synapse onboard counters and totalizers:

Address	Description	Data	R/W	Default
HR0 ~ 14	DI 1 ~ 8 changeover counters	DW	R/W	-
HR60 ~ 74	DI 1 ~ 8 time on totalizers	DW	R/W	-
HR76 ~ 90	DO 1 ~ 8 changeover ounters	DW	R/W	-
HR92 ~ 106	DO 1 ~ 8 time on totalizers	DW	R/W	-

3.7 1-Wire connection The Synapse provides connection for up to 32 digital temperature sensors DS18B20 via 1-Wire bus with a maximum length 200 m, as shown at figure below.



Bus topology. Up to 200 meters.

Auto enumeration for 1-Wire sensors. Each DS18B20 has their own unique serial number. Using a special search algorithm, the Synapse finds and saves the enumeration scheme for the sensors found in the static memory. New sensors still can be added to the existing enumeration by:

- powering on or resetting the module
- writing non-zero value into HR33 register

Address	Description	Data	R/W	Default
IR0 ~ IR31	Temperatures 1 ~ 32	W	R	-1000*
HR33	Total sensors quantity / Init**	W	R/W	0

* -1000 is displayed if a sensor is not present or damaged

** writing 0 to HR33 clears the enumeration.

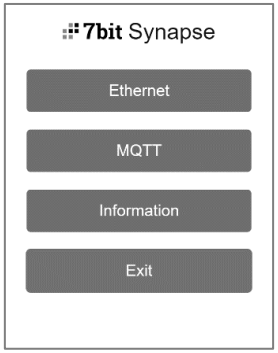
4. Configuration

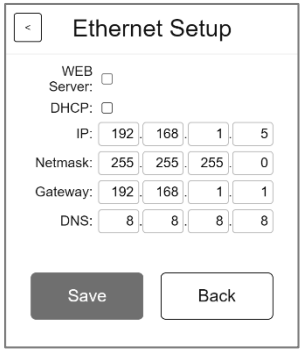
The factory network default settings for the Ethernet interfaces is a DHCP client. So, after power on and plugging it into your router network it automatically will be added to your network. You may setup a static DHCP lease for the module, or use manual IP network setup.

4.1 Configuration mode for IP settings When you have a device with unknown address and want to make quick IP setup, switch the module to the CONFIGURATOIN MODE. Hold the reset button during reboot for a few seconds (status LED will be blinking frequently). The module will start with **192.168.4.1** address. In this mode you can change setting either with **Configuration Web server** or with **Modbus setting registers.** To switch back to normal mode, reboot the module.

4.2 Configuration Web server In the configuration mode, there is Configuration web-page available on the **192.168.4.1**. Instead of Modbus register, you can use this page for module setup. The page can be switched off during setup. To enable it again, use the following register:

Address	Description	Data	R/W	Default
HR39	Configuration Web server enable	W	R/W	1 (yes)

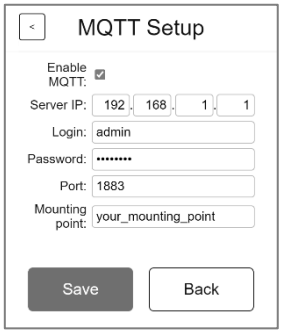




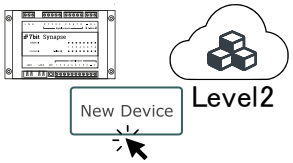
IP configuration It can be done either with the web page or the Modbus registers:

Address	Description	Data	R/W	Default
HR40	Static IP enable	W	R/W	0(no)
HR41 ~ HR44	IP address octets (x.x.x.x)	W	R/W	192.168.1.2
HR45 ~ HR48	Mask octets (x.x.x.x)	W	R/W	255.255.255.0
HR49 ~ HR52	Gateway IP address octets	W	R/W	192.168.1.1

MQTT configuration



Visit level2.webhmi.com.ua to learn about IoT applications with Synapse MQTT capability. Use ready "New device" tool to quickly create your register set in Level2 / WebHMI projects.



5. Diagnostics

The normal LED state upon power on is as follows:

- red POWER - always on.
- green SYSTEM – is blinking once a second (two times faster in configuration mode)
- yellow 1WIRE – blinks when the sensors are polled

The DI/DO LEDs reflects the actual signal states on terminals. During normal boot process, DI/DO ticks in series.

Use "ping" command to check network connection and Modbus/MQTT testing tools to test the protocol connection.

In case of troubles with adding temperature sensors, the most probable cause is the length of 1-Wire bus or its topology (signal or power attenuation, caused too long line, interference due to side branches etc.). First of all, try to connect sensors with short wires. If ok, then check wiring (refer to general Maxim 1-Wire recommendations).

Synapse has internal watchdog, which may reboot the device in case of accidental malfunction. Refer to the following diagnostic registers to check if failures might have occurred.

In a case the device doesn't working properly, please contact to your supplier.

Address	Description	Data	R/W	Default
HR30	Reboot counter	W	R	-1000*
HR31, HR32	Uptime, sec. (low, high)	W	R	
HR34	Free memory	W	R	

6. For more information

If you have any questions or problems related to the operation of the 7Bit™ products, please contact to the unified support service +38 (056) 796-96-90, info@webhmi.com.ua

7. Warranty

The company of "Distributed Data Systems LLC", the manufacturer of 7Bit Synapse IO module (hereinafter referred to as the Manufacturer), expresses its great gratitude for your choice. We did our best to ensure that this product met your requirements, and the quality corresponded to the best standards. The manufacturer sets the life of the Synapse IO module to 10 years in case of its proper usage. The service life is calculated from the date of manufacture of the requirements for warranty obligations and for free repair (replacement of the product) in the case of failure to comply with the conditions set forth below. All the terms of the warranty and free repair (replacement) are in force under the law on consumer protection.

The manufacturer sets a warranty period, counted from the date of sale, and the period of free repair (replacement), subject to compliance with the rules of operation, 12 months. Replacement of defective parts (assemblies, assembly units) in the product during the warranty period does not lead to the establishment of a new warranty period for the entire product, or for replaced parts. The manufacturer declines all responsibility for the possible harm, directly or indirectly caused by the Synapse device to people, animals, property in case event that this is the result of non-compliance with the rules and conditions of use of the product; Intentional or reckless actions of the buyer (consumer) or third parties. Also, the Manufacturer declines all responsibility for the possible damage, directly or indirectly caused by the Synapse device as a result of alteration, damage, loss of data and information

Date of the manufacturer's QA _____

Date of sell _____

Sellers marks _____

Buyer's signature _____