# SIOX SOLUTIONS

SX:NETLINK (ES2) Ethernet/SIOX Gateway

General Description

The ES2 module is a Gateway between a LAN/WAN Ethernet network and a SIOX fieldbus providing remote access to the SIOX bus. To simplify installation, the module is intended for mounting on standard DIN-rails. The unit is fitted with pluggable screw connectors for the supply and SIOX bus and a standard RJ-45 connector for Ethernet 10BaseT (10 Mbit/s). Communications over the Ethernet is carried out in accordance with the SIOX Net protocol or MODBUS TCP/IP. For a description of MODBUS TCP/IP please refer to the document "MODBUS TCP/IP for ES2/EX2" (file "ES2_EX2_MODBUS_ENG.pdf").

Block Diagram
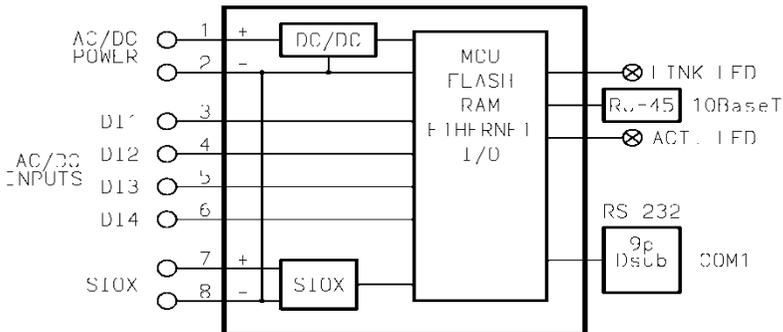
Versions

SX:ACCESS (ES2): handles up to six simultaneous SIOX Net and three MODBUS TCP/IP connections.

Installation and Startup

The ES2 unit is intended for installation on standard DIN-rails conforming to EN50022 (DIN46277-3). The unit should be located inside an enclosure prohibiting access by unauthorized personnel.

The ES2 is a bus master that supplies current to the SIOX bus in the same way as, for instance, the K32 unit does. As a consequence, there is no galvanic isolation between the supply and the bus.

Please note that the ES2 unit has to be configured in order to become operative. This involves setting parameters such as IP-address, subnet mask and SIOX baud rate. Normally, configuration has to be done **before** the unit is installed, mainly because the factory default IP-address will rarely match the intended network. Please refer to 'Configuration' on page 4.

The following **electrical** connections have to be made:

1. Connect a 10BaseT Ethernet cable to the RJ-45 connector. For industrial environments this cable should be shielded for the unit to comply with the more stringent EMC requirements.

2. **If a DC supply is used:** connect the positive supply to screw terminal 1 and the negative supply to screw terminal 2. The supply voltage range is 18 - 35 V DC.
    If an AC supply is used: if one of the two supply wires is regarded as "ground", connect it to terminal 2 and the other to terminal 1. The supply voltage range is 12 - 24 V AC.

3. Connect the SIOX bus to screw terminals 7 and 8. Normally, the bus can be connected unpolarized, i.e. either way, unless there are SIOX modules connected to the bus that are sensitive to the polarity. Terminal 7 is the positive bus terminal whereas terminal 8 is the negative. Note that the negative supply screw terminal 2 is internally connected to terminal 8.

4. If the Digital Inputs DI1-DI4 will be used, connect the external signals to the screw terminals 3 - 6. These inputs will accept both DC and AC voltages in the range 0 - 35 V DC and 0 - 24 V AC.

The SIOX modules should be interconnected through a two-wire, low capacitance twisted pair. Shielded cables may be used but unless a correct strategy for shield grounding is adopted, it may prove to be of little benefit. Instead, the capacitance between the shield and the bus wires will add to the total capacitive load on the

SIOX bus and decrease the maximum distance over which communication can be carried out for a given bit rate. The total resistance of the bus should normally not be higher than 2 * 50Ω.

Provided the ES2 unit is properly configured, it will now be ready for operation.

After power is applied to the unit, check the yellow Link LED, located on the left side of the RJ-45 connector. It will be activated if there is a working connection to another network unit. The green Activity LED, located on the right side of the RJ-45 connector will flash when there is activity on the Ethernet.

Power Supply

As stated, power supply input voltage range is 18 - 35 V DC or 12 - 24 V AC. Power consumption, SIOX excluded, is approximately 1,5 W during normal operation within specified supply voltages. Maximum power consumption will occur if the SIOX bus is accidentally shorted. At 35 V DC supply, up to 5 W may be dissipated. To insure that the unit will always be able to start, even with a shorted SIOX bus, the supply must be capable to output at least 300 mA.

Introduced in firmware version 1.12 the green LED in position "L1" will be lit 10 seconds after power-on to indicate that the module has power, as it is not always possible to tell from the SIOX LED (i.e. shorted bus).

Configuration

Before the unit can be operative it has to be configured for the task. This is accomplished by communicating with the unit thru an Ethernet connection in compliance with the SIOX Net protocol. By doing so, a few configuration parameters can be changed.

Preferably, use a network cable and connect the unit directly to the computer that will be used for configuration. If the unit is connected directly to a LAN (Local Area Network), there is a small possibility that the unit's IP-address will be the same as some other equipment. This will disturb the operation of the other system. Please contact the network administration to check this out.

If not already accomplished, download and install the *Visual Setup* software from www.siox.com. Also download the *ES2setup.dff* which, when run by the *Visual Setup*, will provide a configuration interface for the ES2 unit. At the same time it is a good idea to download setup dff-files for other module types that are used as well.

When all is working, the ES2 unit will act as a virtual SIOX module accessible on one SIOX address in the range 1 - 63 depending on earlier configuration. This address cannot be used by other SIOX modules. Factory default address is 63, which preferably should be left unchanged. This leaves addresses 1 - 62 for other modules.

However, the first thing to do is to establish a connection with the unit, so we will need to know the unit's IP-address. There are three ways to do this:

1.   If the unit has previously been configured to a known IP-address, then try to use this address. But this will only work if the unit remains installed on the network it was originally configured for.

2.   If the unit is new or otherwise set to factory default, it will be configured to IP-address 192.168.0.234. However, as there are many network address ranges in use, this address will not be accessible on a LAN unless that network uses the 192.168.0.xxx address range.

3.   The third way to get in contact with the unit is more universal and will also make it possible to recover a module set at an unknown IP-address. To facilitate this, the unit is equipped with a push button Reconfiguration Switch. Use a suitable tool to carefully press the switch under the plastic cover. When power is applied to the unit, the green LED in position "L1" will make a short blink. If the switch is pressed within two seconds **after** the blink, it will set the unit in a special 'hunt' mode and the LED will instantly be lit. The unit will then be able to discover what network address range that is used, and readdress itself accordingly. It is described in detail below. Please note, if the switch is pressed **during** power-up the ES2 will enter a firmware update mode instead. If this happened inadvertently, recover by removing the power and redo the operation.
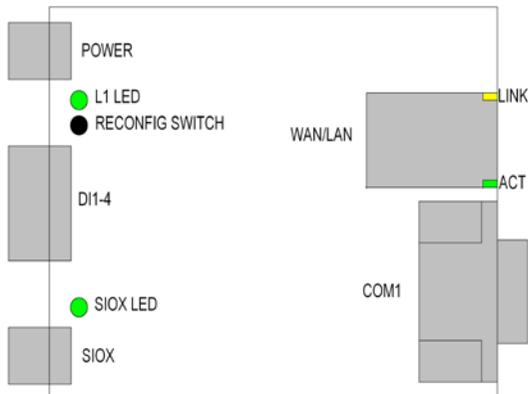
Now use the *Visual Setup* software to run the *ES2setup.dff* in an attempt to establish a connection with the unit on IP-address xxx.xxx.xxx.234 (press F6 to enter SIOX Bus setup to change IP-address). The 'xxx'-marked portions of the IP-address should be filled in with values corresponding to the address range used by the local network (or a directly connected PC) to which the unit is now connected. For instance, if the local network is configured to use the 192.168.4.xxx range, then the ES2 unit will be accessible at IP-address 192.168.4.234. Enter the address in the Server Address field (seen by pressing F6 to enter SIOX Bus setup).

When an access attempt to the ES2 unit is detected, it will reconfigure itself and perform a restart. Occasionally, it might be necessary to retry the access attempt by pressing F6 and clicking on the *ReInit* button on the right side.

Access to the unit should now be possible. Unless the ES2 unit uses the default address 63, a search must be performed over the entire SIOX bus address range 1 - 63 in order to find the ES2 unit. Note that several other SIOX modules may appear if a SIOX bus is connected to the ES2.

To summarize the steps involved to get in contact with the unit:

1. Connect the ES2 unit to an Ethernet, either to a LAN or directly to another computer.

2. When power to the unit is applied, push the Reconfiguration Switch within two seconds **after** the short blink on LED "L1". The LED should be activated.

3. Try to access the unit at IP-address xxx.xxx.xxx.234. If the module's SIOX address is different from the default address 63, a search may be necessary that will query the SIOX bus for answering modules. In the list of detected modules, select the ES2 unit for further operations.

4. When contact is established, the unit may be reconfigured. Please note, if configuration of another ES2 module is attempted after a previous one, it will take a few minutes for detection. This is because the communication attempts will use the previous ES2 unit's MAC-address (Media Access Control address). After some time there will be a new request for the MAC-address that the new ES2 uses. It will answer to this request after which communication will be possible.

If the ARP cache in the PC (Personal Computer) is cleared **before** contact is attempted, answer from the ES2 unit will be almost immediate. This forces the PC to send an ARP request, which the ES2 is waiting for. The ARP cache is cleared by clicking on **Start**, launching "**cmd.exe**" and then entering the command string "**arp -d ***". If several ES2 units should be configured, execute this command each time a new unit is connected in order to speed up the process.

When contact is established with the unit, the following configurations may be checked and changed:

- **IP-address and Subnet mask** for the network where the unit eventually will be installed. It might be a good idea to perform these changes as the final ones after the rest of the configurations are handled. Otherwise, an inadvertent restart of the unit will necessitate a repeated recovery process as previously described.

- **Default Gateway address**. Used by the ES2 to know where to send communications with destination addresses outside the network where it is located. Will typically be the address of the firewall/router.

- **TCP port number** used for SIOX Net communication. This is the port number that the central should try to connect to when establishing contact with the ES2. Factory default is 1024 which will usually work fine if the unit is located on a LAN (Local Area Network) or directly connected to the Internet. However, if the unit is located on a LAN and access from Internet is desirable, firewall configurations must be considered as well, as they normally will prevent connection attempts from the Internet to a LAN. In this case a 'hole' thru the firewall specifically directed to the ES2 IP-address must be opened. This is perfectly safe for the LAN and will not represent a security risk because the ES2 unit does not contain any operating system that can be manipulated to perform malicious activity on the LAN. Please contact the network administration to check if this is feasible. However, it is very important that the firewall configuration will be restored in case the ES2 unit is permanently removed. Otherwise other equipment occupying the same IP-address could possibly represent a security hazard.

- **ES2 address** (1 - 63) on the SIOX bus for its virtual SIOX module, thru which these configurations are carried out. This address can not be used by any SIOX module connected to the SIOX bus. Factory default address is 63.

- **SIOX bus baud rate.** Available baud rates are 300, 600, 1200, 2400, 4800, 9600 and 19200 baud. Factory default is 4800 baud.

- **SIOX bus current** drive capability 0, 25, 50, 75 or 100 mA. Factory default is 100 mA.

- **Additional SIOX timeout** (0 - 63 ms), used in conjunction with modems or radio modules where delays inherent in these units must be considered. Factory default is 0 ms.

Start configuration by writing SIOX baud rate to parameter with the Write Enable flag set. Refer to *Parameter Description* below for further details. If using the

ES2setup.dff, simply check the box *EEPROM Write Enable* before changing any configuration, otherwise it will not be possible to make any changes.

When finished, move the unit to its intended installation point. The new configurations will take effect after power is applied. Access to the unit may quickly be tested by sending a 'ping' to it. Use *Visual Setup* or the intended system application for further testing including access to the SIOX bus to verify that all connected modules are responding.

Up to six simultaneous SIOXNet communications are supported.

MODBUS TCP/IP

There are no configurations specific for MODBUS TCP to handle.

Use MODBUS TCP/IP standard port 502 for the communications.

Up to three simultaneous MODBUS TCP/IP communications are supported.

For a description of MODBUS TCP/IP please refer to the document
"MODBUS TCP/IP for ES2/EX2" (file "ES2_EX2_MODBUS_ENG.pdf").

Parameter Description

The ES2 contains an EEPROM to permanently store configuration data. Most changes requires a restart of the unit, either by power off/on or by writing $FFFF_{16}$ to the <u>first</u> parameter number 0. This initiates a full soft reset, using the updated EEPROM values for initialization. All changes should be carried out in EEPROM. Writing to RAM has no effect. EEPROM parameters used are parameter numbers 00 - $2F_{16}$ except for 02 - 05_{16} and 11 - 19_{16} that are reserved for future use. Likewise, parameters from 30_{16} and upwards are reserved for the application running in the ES2 unit. **Changes are normally carried out by using the *ES2setup.dff*.**

Definitions of Parameter setup	
$(XXXX_{16})$	Factory preset information for the parameter.
tttt	One nibble (4bit), where the left bit is the most significant bit and the right bit is the least significant.
tttt tttt tttt tttt	One parameter (2byte/16bit), where the left byte is the most significant byte and the right byte is the least significant.
'	Only this bit is relevant.
t	This bit is used for other purposes.

EEPROM Parameter Setup (16bits/ parameter):	
Parameter 00: (0700_{16})	**Restart unit to effectuate change**
'''' '''' '''' ''''	$FFFF_{16}$ = Restart of the unit.
'222 tttt tttt tttt	1 = Write Enable flag. Cleared by reset.
tttt ''''' tttt tttt	3 = 300 bits/second transmission speed. 4 = 600 bits/second transmission speed. 5 = 1200 bits/second transmission speed. 6 = 2400 bits/second transmission speed. 7 = 4800 bits/second transmission speed. 8 = 9600 bits/second transmission speed. 9 = 19200 bits/second transmission speed.

Note that the Write Enable flag must be set to allow writing to other parameters. Therefore, start the configuration by writing the desired SIOX baud rate to this parameter with the Write Enable flag set.

For instance, writing 8900_{16} will set the SIOX baud rate to 19200 baud and also set the Write Enable flag so other parameters can be written, too. The flag, if set, will automatically be cleared at next power-on. Otherwise, if power to the unit cannot be cycled when the configuration has been completed, either repeat the write but **without** the Write Enable set, or write $FFFF_{16}$ to the parameter for a restart of the unit.

Parameter 01: ($3F04_{16}$) **Unit does not need to be restarted after change**	
tt'' '''' tttt tttt	$01\text{-}3F_{16}$ = Module address
tttt tttt tttt t'''	SIOX bus current. 0 = 0 mA. Another unit must supply the current. 1 = 25 mA. 2 = 50 mA. 3 = 75 mA. 4 = 100 mA.

Normally, a bus current of 100 mA is recommended. However, if the bus wires are very resistive, ES2 has the provision for selectable bus current and may therefore be able to communicate on wires otherwise deemed unusable. By decreasing the bus current, voltage lost in the wires will be correspondingly lower. However, there are two disadvantages of lower bus current. Firstly, the lower current will lead to a slower charge/recharge of the wire capacitance which may necessitate a change to a lower baud rate. Secondly, fewer SIOX modules can be connected to the bus.
As a complement, the SIOX R30 Bus Expander unit can be used if a bus segment needs to be strengthened.

Parameter 05: (0000_{16})	
tttt tttt tttt ''''	$XXX0\text{-}XXXF_{16}$ = Status for Digital Inputs DI4-DI1.

Parameter 06: (0400_{16})	**Restart unit to effectuate change**
'''' '''' '''' ''''	$0400\text{-}FFFF_{16}$ = TCP Port Number $1024\text{-}65535_{10}$.

This is the port number that the central should try to connect to when establishing contact with the ES2 using the SIOXNet protocol. Default port number is 1024_{10}.

Parameter 07: (0000_{16})	**Restart unit to effectuate change**
tttt tttt tt" ""	00-$3F_{16}$ = Additional SIOX timeout 0-63_{10} ms. Leave at zero for normal conditions. However, if there are special SIOX modules connected to the bus, i.e. modems or radio modules, extra timeout may be added to compensate for the delay in these units.

Parameter 08: ($00C0_{16}$)	**Restart unit to effectuate change**
"" "" "" ""	0000-$00FF_{16}$ = First byte of IP-address 0-255_{10}.

Parameter 09: ($00A8_{16}$)	**Restart unit to effectuate change**
"" "" "" ""	0000-$00FF_{16}$ = Second byte of IP-address 0-255_{10}.

Parameter 0A: (0000_{16})	**Restart unit to effectuate change**
"" "" "" ""	0000-$00FF_{16}$ = Third byte of IP-address 0-255_{10}.

Parameter 0B: ($00EA_{16}$)	**Restart unit to effectuate change**
"" "" "" ""	0001-$00FE_{16}$ = Fourth byte of IP-address 1-254_{10}.

Parameter 0C: ($00FF_{16}$)	**Restart unit to effectuate change**
"" "" "" ""	0000-$00FF_{16}$ = First byte of subnet mask 0-255_{10}.

Parameter 0D: ($00FF_{16}$)	**Restart unit to effectuate change**
"" "" "" ""	0000-$00FF_{16}$ = Second byte of subnet mask 0-255_{10}.

Parameter 0E: ($00FF_{16}$)	**Restart unit to effectuate change**
"" "" "" ""	0000-$00FF_{16}$ = Third byte of subnet mask 0-255_{10}.

Parameter 0F: (0000_{16})	**Restart unit to effectuate change**
"" "" "" ""	0000-$00FF_{16}$ = Fourth byte of subnet mask 0-255_{10}.

Parameter 16: (0000_{16})	**Restart unit to effectuate change**
"" "" "" ""	0000-$00FF_{16}$ = First byte of Default Gateway address 0-255_{10}.

Parameter 17: (0000_{16})	**Restart unit to effectuate change**
"" "" "" ""	$0000\text{-}00FF_{16}$ = Second byte of Default Gateway address $0\text{-}255_{10}$.

Parameter 18: (0000_{16})	**Restart unit to effectuate change**
"" "" "" ""	$0000\text{-}00FF_{16}$ = Third byte of Default Gateway address $0\text{-}255_{10}$.

Parameter 19: (0000_{16})	**Restart unit to effectuate change**
"" "" "" ""	$0000\text{-}00FF_{16}$ = Fourth byte of Default Gateway address $0\text{-}255_{10}$.

The Default Gateway address should be configured if there is need for the ES2 to be accessed from another network. This address tells the ES2 where to send its answers in order to reach the external network. For instance, a firewall/router is connected between the Internet and the LAN and access from Internet to the ES2 is desired. To accomplish this a 'hole' in the firewall has to be opened to the IP-address and port number used by the ES2, and the ES2 Default Gateway address parameters should be set equal to the address that the firewall/router has on the LAN side.

Parameter 1A - 1F: (0000_{16})	
"" "" "" ""	$0000\text{-}00FF_{16}$ = Module MAC-address. Not user configurable.

Parameter 20 - 2F: (0000_{16})	
"" "" "" ""	Reserved for future use. Should be set to zero.

Parameter 30 - FFF: (0000_{16})	
"" "" "" ""	Reserved for application use.

Electrical Specifications

(T_{amb} = 20 $^\circ$C)	Min	Typ	Max	Unit
Power Supply Voltage	18	24	35	V DC
Power Supply Voltage	12	18	24	V AC

Power Supply Current (@24 V DC)
    Idle, no SIOX communication
    Normal operation
    SIOX bus shorted
		55
		90
		150
				mA
				mA
				mA

DI1-4 Input voltage			35	V DC
DI1-4 Input voltage			24	V AC
DI1-4 Input activation voltage		10		V DC
DI1-4 Input activation voltage		10		V AC

Environmental Specifications

	Min	Typ	Max	Unit
Operating Temperature Range	0		+55	$^\circ$C
Storage Temperature Range	-20		+70	$^\circ$C

Mechanical Specifications

Case Size (W x H x D)	71 x 108 x 58		mm
Weight	125		g

Assistance

Regarding safety and technical matters is available from:

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