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## **IMPORTANT NOTICE**

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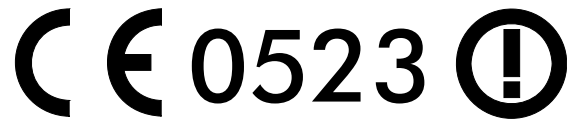
**SATEL PRODUCTS HAVE NOT BEEN DESIGNED, INTENDED NOR INSPECTED TO BE USED IN ANY LIFE SUPPORT RELATED DEVICE OR SYSTEM RELATED FUNCTION NOR AS A PART OF ANY OTHER CRITICAL SYSTEM AND ARE GRANTED NO FUNCTIONAL WARRANTY IF THEY ARE USED IN ANY OF THE APPLICATIONS MENTIONED.**

## PRODUCT CONFORMITY

### SATEL I-LINK 100 MODBUS

Hereby, SATEL Oy declares that SATEL I-LINK 100 MODBUS I/O converters are in compliance with the essential requirements and other relevant provisions of Directive 89/336/EEC.

Therefore the equipment is labelled with the following CE-marking.



## **WARRANTY AND SAFETY INSTRUCTIONS**

Read these safety instructions carefully before using the product:

Warranty will be void, if the product is used in any way, which is in contradiction with the instructions given in this manual, or if the housing of the radio modem has been opened or tampered with.

The radio modem is to be used only on frequencies allocated by local authorities and without exceeding the given maximum allowed output power ratings. SATEL is not responsible, if any products manufactured by it are used in unlawful ways.

The devices mentioned in this manual are to be used only according to the instructions described in this manual. Faultless and safe operation of the devices can be guaranteed only if the transport, storage, operation and handling of the devices are appropriate. This also applies to the maintenance of the products.

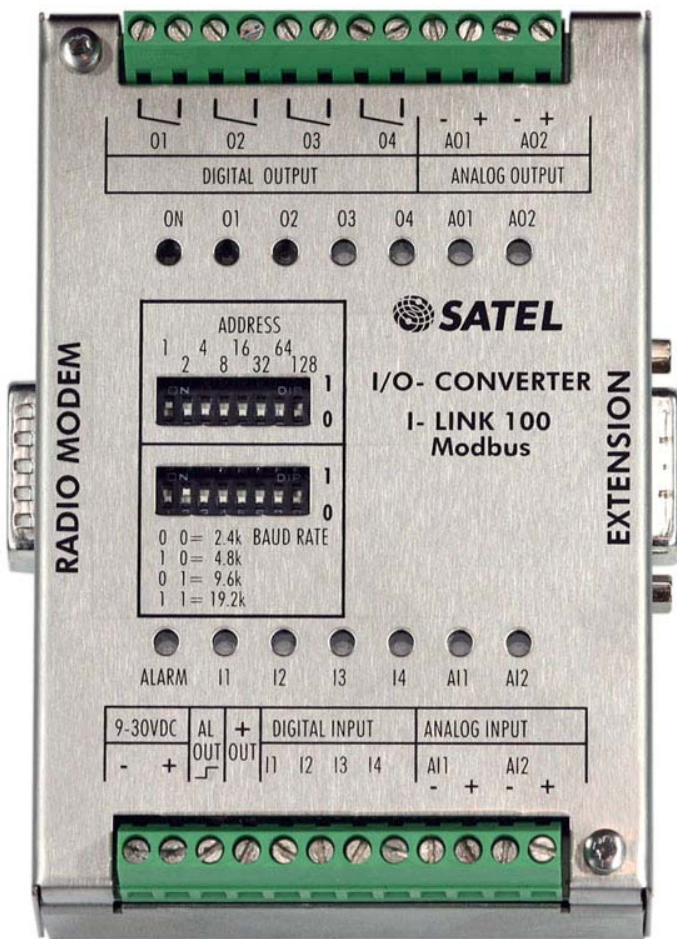
To prevent damage both the radio modem and any terminal devices must always be switched OFF before connecting or disconnecting the serial connection cable. It should be ascertained that different devices used have the same ground potential. Before connecting any power cables the output voltage of the power supply should be checked.

Salo, Finland 2006

# 1 GENERAL

## 1.1 SATEL I-LINK 100 MODBUS I/O-converter

The SATEL I-LINK 100 MODBUS is an I/O-converter for Modbus systems. The device works together with SATELLINE modems. A digital or analogue I-LINK 100 MODBUS signal can be sent / received through the radio modem using the Modbus protocol.



### Output Connectors

O1...O4 Digital outputs  
- + +/- for analogue outputs  
AO1, AO2 Analogue outputs

### Output indicators

ON Power ON/OFF  
O1-O4, AO1, AO2 Output indicators

### Setting switches

ADDRESS Modbus address.  
Max. 247 pcs.  
BAUD Baud rate settings  
PARITY Even, None, Odd  
- lower row No. 3, 4

### Input indicators

ALARM Indicator for failed transmission  
I1...I4, AI1, AI2 Input indicators

### Input Connectors

9-30VDC/ - + Supply Voltage  
AL OUT Alarm output  
+ Common + for digital inputs and extension units  
I1...I4 Digital inputs  
AI1, AI2 Analogue inputs  
- + -/+ for analogue inputs  
RADIO MODEM Connector for radio modem  
EXTENSION Connector for extension units I-LINK 200 and I-LINK 300.

## 2 SPECIFICATIONS

FEATURE	min-max	typical	note
Voltage	+9...+30 Vdc	24 Vdc, typical	
Power consumption	0.03...0.1 VA	-	
Serial Interface	RS-232 $\pm$ 15 Vdc	$\pm$ 6 Vdc	active RS232
Extension Interface	-0.3...+6 Vdc	0.5...5 Vdc	active TTL
Response time	< 250 ms	< 300 ms	@ 9600 bps
Operational temperature	-25...+55 °C		
Transfer rates	2400 – 19200 bps		
Stability	$\pm$ 1 %		@ whole temp. range

### ANALOGUE SIGNALS

Inputs, 2 pcs	0 – 25 mA	4 – 20 mA	resistive 165 $\Omega$
Outputs, 2 pcs	0 – 25 mA	4 – 20 mA	active
Resolution		12 bits	
Accuracy		<0.4 %	

### DIGITAL SIGNALS

Inputs, 4 pcs	0 – 35 Vdc	0 – 30 Vdc	resistive 4-5 k $\Omega$
Outputs, 4 pcs	0 – 250 Vac / 2 A	0 – 250 Vac / 2A	relay contacts

### INDICATORS

Indicators	Power ON/OFF, digital/analogue IN/OUT, Alarm
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### OTHER OUTPUTS

Alarm Output	0 – 35 Vdc / 30 mA	24 Vdc / 20 mA	active + 30 mA
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### GENERAL

Casing	Stainless steel
Connectors	D-15 for SATELLINE radio modem, D-15 for the extension module
Size L x W x H	123 x 85 x 30
Weight	120 g
Mounting	Wall plate or DIN-rail
IP	IP-20
Modem compatibility	SATELLINE-2ASxE, 3AS-series and SATELLINE-1870

### Connection between I-LINK 100 MODBUS and SATELLINE radio modem

Direction by the I-LINK 100 MB	Signal	I-LINK 100 MB, D-15
Out	+VB, DTR	1, 14, 15
Out	GND, SGND	7, 8
In	RD	9
Out	TD	11
In	CTS	6

## **3 FUNCTIONS**

### **3.1 Operational Voltage, 9 – 30 Vdc**

- The supply voltage is connected to the connector 9-30 VDC (-) and (+).
- + OUT is connected to +VDC through an internal fuse. The supply voltage for the extension units must be taken from this output. It can also be used as the supply voltage to the analogue input sensors.

### **3.2 Alarm output, AL OUT**

- The AL OUT can be activated by the Safe Mode command. When activated the output state goes to +VDC. The Alarm is typically activated if the I-LINK 100 MODBUS does not receive a polling signal in a pre-defined time.

### **3.3 +OUT**

- A voltage output for the extension units. Connected to +VDC through an internal fuse.

### **3.4 Digital Inputs (I1...I4) and Outputs (O1...O4 )**

- **Inputs:** 4 pcs. Activated with + voltage.
- **Outputs:** 4 pcs. Open relay contacts. Can be connected to any 0 - 250 Vac / 2A load.

### **3.5 Analogue inputs (A1 -, A1 +, A2-, A2+) and outputs (AO1-, AO1+, AO2-, AO2+)**

- **Inputs:** 2 pcs. Normal range is 4 - 20 mA. Whole range is 0 – 25 mA showing that the limits have been exceeded. The input load is resistive 165 Ω.
- **Outputs:** 2 pcs. Normal range is 4 – 20 mA.

### **3.6 Indicators**

- **ON.** Power ON/ OFF. Illuminated when +VCD connected.
- **O1...O4, AO1, AO2.** Showing the status of the output. Illuminated when there is information on the output. Flashing when range has been exceeded. OFF, when low state or nothing on the input.
- **ALARM.** Illuminated, if a fail in transmission has occurred.
- **I1...I4, AI1, AI2.** Showing the status of the input, illuminated steadily when the input is in the normal 4 – 20 mA range. Flashing when range has been exceeded. OFF, when low state or nothing on the input.

### **3.7 Switches**

- **Upper Row, ADDRESS.** Modbus address. The maximum number of addresses is 247. Address 1 = 10000000, address 2 = 01000000, address 3 = 11000000 etc.
- **Lower Row (1 and 2), BAUD kb/s.** The baud rate can be selected as follows: 00=2.4, 10=4.8, 01=9.6, 11=19.2.
- **Lower Row (3 and 4), PARITY.** 00= Even, 01=None, 10=Odd, 11=NOT VALID.

## 4 OPERATION

### 4.1 Preliminary settings

- Connect SATELLINE radio modem to the PLC or to PC's COM-Port.
- Connect the SATELLINE radio modem to the I-LINK 100 MODBUS directly to the RADIO MODEM -connector or using the interface cable.
- Before connecting the device to a power supply, connect all inputs / outputs that are to be used.
- Select the SATEL I-LINK 100 MODBUS BAUD-rate. 00=2.4, 10=4.8, 01=9.6, 11=19.2 (9600 bps is a default setting, but can be changed to be any of the BAUD-rates given above).
- Check that the radio modem baud rate is same as for the I-LINK and the other parameters are "E-8-1"
- When both units have these basic settings the supply voltage can be connected.
- NOTE, that the radio modem parity bit is Even.

#### Updates

The updates are controlled by the Modbus Master that sends messages to the substations or asks status information from them.



## 5 MODBUS SERIAL TRANSMISSION MODE

This system supports only the RTU (Remote Terminal Unit) serial transmission mode. Each 8-bit message byte contains two 4-bit hexadecimal characters. The message is always transmitted in a continuous stream.

The message is considered finished after the following approximate delays in this system:  
5ms @ 19200, 7-9 ms @ = 9600, 12-15ms @ 4800, 15-20ms @ 2400.

In the specification of the Modbus standard the message is considered finished if the delay is more than 3.5 characters.

### Supported baudrates and modes:

<i>Mode</i>	<i>Connection settings</i>	<i>DIP switch description</i>
RTU	2400, 8, E, 1	0 0
RTU	4800, 8, E, 1	1 0
RTU	9600, 8, E, 1	0 1
RTU	19200, 8, E, 1	1 1

## 6 MODBUS ADDRESSES

Valid addresses are from 1-247 (selected by the address dip-switches). Address 0 is reserved for broadcast address. This device does not response to a broadcast message. All functions are not supported when using broadcast message.

## 7 SUPPORTED MODBUS FUNCTIONS

This device supports the following Modbus functions. H= bytes are described as hexadecimal characters.

<i>CODE</i>	<i>FUNCTION</i>	<i>MEMORY AREA</i>
01H	Read Coil status	0xxxx
02H	Read district inputs	1xxxx
03H	Read Holding Registers	4xxxx
04H	Read Input Registers	3xxxx
05H	Force Single Coil	0xxxx
0FH	Force Multiple Coils	0xxxx
10H	Set Multiple Registers	4xxxx
11H	Report Slave ID	Hidden

## 8 I-LINK MAIN DEVICE DATA AREAS

Note! All addresses described in this documentation are written as "PC-mode". Internally the addresses are 1 less, so in the device the BASE is 0. In this document the BASE is 1.

### 8.1 Digital Inputs

These values are read only. Only the function 02H can be used.

<i>Register</i>	<i>Access</i>	<i>Description</i>
10001	Read only	Digital Input 1
10002	Read only	Digital Input 2
10003	Read only	Digital input 3
10004	Read only	Digital Input 4

### 8.2 Digital Outputs

The usable functions are: 01H, 05H and 0FH.

<i>Register</i>	<i>Access</i>	<i>Description</i>
101	Read/Write	Digital output 1
102	Read/Write	Digital output 2
103	Read/Write	Digital output 3
104	Read/Write	Digital output 4

### 8.3 Analogue Inputs

294 (Hex) = 4mA, CE4 (Hex) = 20mA (increment is 0.006059082 mA / step).

The usable function is 04H.

<i>Register</i>	<i>Access</i>	<i>Description</i>
30001	Read only	Analogue Input 1, value between 0-4095 (0 mA ... 24.818 mA)
30002	Read only	Analogue Input 2, value between 0-4095 (0 mA ... 24.818 mA)

## 8.4 Analogue outputs

294 (Hex) = 4mA, CE4 (Hex) = 20mA (increment is 0.006059082mA/step).  
 The usable functions are 03H and 10H.

<i>Register</i>	<i>Access</i>	<i>Description</i>
42101	Read/Write	Analogue output 1, value between 0-4095 (0 mA ... 24.818 mA)
42102	Read/Write	Analogue output 2, value between 0-4095 (0 mA ... 24.818 mA)

## 8.5 Report Slave ID.

The report slave id function will response with slave information, SW-version etc.  
 The information data is following:

<i>Data value</i>	<i>Description</i>
X	Slave ID. Selected slave ID. (1-247)
11H	Function code, always 11H
0CH	Response length, always 0CH
XXXX	Response data. 6 characters, device model, 1 space, 5 characters device version. For example: I-LINK v1.0B
XX	Device status FFH device ON, 00H device Off.
CRC	CRC for message.

## 8.6 Safe Mode.

The Safe Mode supports functions 01H, 0FH, 05H, 03H and 10H.

<i>Register</i>	<i>Access</i>	<i>Description</i>
45001	Read/Write	Safe mode set 0 = No safe mode 1 = Alarm light only. Alarm goes automatically off when valid message is received. 2 = Alarm light ON. Outputs to safe mode settings. Alarm goes automatically off when valid message is received. 3 = Like 1, except alarm will not go OFF automatically. Master must turn it off. 4 = Like 2, except alarm will not go OFF automatically, Master must turn it OFF.
5101	Read/Write	Safe mode setting for digital output 1
5102	Read/Write	Safe mode setting for digital output 2
5103	Read/Write	Safe mode setting for digital output 3
5104	Read/Write	Safe mode setting for digital output 4
5501	Read/Write	0 = Alarm OFF, 1 = Alarm ON
45201	Read/Write	Safe mode setting for Analogue Output 1
45202	Read/Write	Safe mode setting for Analogue Output 2
45011	Read/Write	High 16 bit off safe mode selected time. (32 bit values hundredth part of second, 1000 = 10 seconds)
45012	Read/Write	Low 16 bit off safe mode selected time. (32 bit values hundredth part of second, 1000 = 10 seconds)

## 9 EXTERNAL DEVICES

### 9.1 Digital inputs

The usable function is 02H.

<i>Register</i>	<i>Access</i>	<i>Description</i>
10011	Read only	External device 1 Digital input 1
10012	Read only	External device 1 Digital input 2
10013	Read only	External device 1 Digital input 3
10014	Read only	External device 1 Digital input 4
10015	Read only	External device 1 Digital input 5, Only if device has 6 inputs!
10016	Read only	External device 1 Digital input 6, Only if device has 6 inputs!
10021	Read only	External device 2 Digital input 1
10022	Read only	External device 2 Digital input 2
10023	Read only	External device 2 Digital input 3
10024	Read only	External device 2 Digital input 4
10025	Read only	External device 2 Digital input 5, Only if device has 6 inputs!
10026	Read only	External device 2 Digital input 6, Only if device has 6 inputs!
10031	Read only	External device 3 Digital input 1
10032	Read only	External device 3 Digital input 2
10033	Read only	External device 3 Digital input 3
10034	Read only	External device 3 Digital input 4
10035	Read only	External device 3 Digital input 5, Only if device has 6 inputs!
10036	Read only	External device 3 Digital input 6, Only if device has 6 inputs!

NOTE! If the device has no input (for example trying to read digital input 5, even though external device has only 4 inputs or external device is not connected), the response will be "illegal data address"!

## 9.2 Digital Outputs

The usable functions are: 01H, 05H and 0FH.

<i>Register</i>	<i>Access</i>	<i>Description</i>
111	Read/Write	Ext. device 1 Digital output 1
112	Read/Write	Ext. device 1 Digital output 2
113	Read/Write	Ext. device 1 Digital output 3
114	Read/Write	Ext. device 1 Digital output 4
115	Read/Write	Ext. device 1 Digital output 5, only if external device has 6 digital outputs
116	Read/Write	Ext. device 1 Digital output 6, only if external device has 6 digital outputs
121	Read/Write	Ext. device 2 Digital output 1
122	Read/Write	Ext. device 2 Digital output 2
123	Read/Write	Ext. device 2 Digital output 3
124	Read/Write	Ext. device 2 Digital output 4
125	Read/Write	Ext. device 2 Digital output 5, only if external device has 6 digital outputs
126	Read/Write	Ext. device 2 Digital output 6, only if external device has 6 digital outputs
131	Read/Write	Ext. device 3 Digital output 1
132	Read/Write	Ext. device 3 Digital output 2
133	Read/Write	Ext. device 3 Digital output 3
134	Read/Write	Ext. device 3 Digital output 4
135	Read/Write	Ext. device 3 Digital output 5, only if external device has 6 digital outputs
136	Read/Write	Ext. device 3 Digital output 6, only if external device has 6 digital outputs

NOTE! If the device has no output (for example trying to write digital output 5, even though external device has only 4 outputs, or external device is not connected), the response will be "illegal data address"!

## 9.3 Analogue Inputs

The usable function is 04H.

<i>Register</i>	<i>Access</i>	<i>Description</i>
30003	Read only	External device 1, Analogue Input 1, value between 0-4095
30004	Read only	External device 1, Analogue Input 2, value between 0-4095
30005	Read only	External device 2, Analogue Input 1, value between 0-4095
30006	Read only	External device 2, Analogue Input 2, value between 0-4095
30007	Read only	External device 3, Analogue Input 1, value between 0-4095
30008	Read only	External device 3, Analogue Input 2, value between 0-4095

Note! If the external device is not connected or has no analogue ports, the response will be "illegal data address"!

## 9.4 Analogue outputs

The usable functions are 03H and 10H.

<i>Register</i>	<i>Access</i>	<i>Description</i>
42103	Read/Write	External device 1, Analogue output 1, value between 0-4095.
42104	Read/Write	External device 1, Analogue output 2, value between 0-4095.
42105	Read/Write	External device 2, Analogue output 1, value between 0-4095.
42106	Read/Write	External device 2, Analogue output 2, value between 0-4095.
42107	Read/Write	External device 3, Analogue output 1, value between 0-4095.
42108	Read/Write	External device 3, Analogue output 2, value between 0-4095.

Note! If the external device is not connected or has no analogue ports, the response will be "illegal data address"!

## 10 SAFE MODE, DIGITAL OUPUTS (I-LINK 300)

<i>Register</i>	<i>Access</i>	<i>Description</i>
5111	Read/Write	Safe mode setting for External device 1, digital output 1
5112	Read/Write	Safe mode setting for External device 1, digital output 2
5113	Read/Write	Safe mode setting for External device 1, digital output 3
5114	Read/Write	Safe mode setting for External device 1, digital output 4
5115	Read/Write	Safe mode setting for External device 1, digital output 5
5116	Read/Write	Safe mode setting for External device 1, digital output 6
5121	Read/Write	Safe mode setting for External device 2, digital output 1
5122	Read/Write	Safe mode setting for External device 2, digital output 2
5123	Read/Write	Safe mode setting for External device 2, digital output 3
5124	Read/Write	Safe mode setting for External device 2, digital output 4
5125	Read/Write	Safe mode setting for External device 2, digital output 5
5126	Read/Write	Safe mode setting for External device 2, digital output 6
5131	Read/Write	Safe mode setting for External device 3, digital output 1
5132	Read/Write	Safe mode setting for External device 3, digital output 2
5133	Read/Write	Safe mode setting for External device 3, digital output 3
5134	Read/Write	Safe mode setting for External device 3, digital output 4
5135	Read/Write	Safe mode setting for External device 3, digital output 5
5136	Read/Write	Safe mode setting for External device 3, digital output 6

## 11 SAFE MODE, ANALOGUE DEVICES (I-LINK 200)

<i>Register</i>	<i>Access</i>	<i>Description</i>
45203	Read/Write	Safe mode value for external device 1 analogue 1
45204	Read/Write	Safe mode value for external device 1 analogue 2
45205	Read/Write	Safe mode value for external device 2 analogue 1
45206	Read/Write	Safe mode value for external device 2 analogue 2
45207	Read/Write	Safe mode value for external device 3 analogue 1
45208	Read/Write	Safe mode value for external device 3 analogue 2

Note! When writing the safe mode setting changes, the response is delayed up to 2 seconds, because all the changes (except ALARM) are stored / written to EEPROM.

## 12 FACTORY SETTINGS



The I-LINK 100 MODBUS I/O-converter is shipped with the following default settings (unless specifically ordered with settings other than those listed below):

FIXED SETTINGS DEFINED AT THE TIME OF ORDER	
ADDRESS	0000 0000
BAUD	11 = 19200 bps

### 13 ACCESSORIES

Interface cables for connecting of I-LINK 100 MODBUS and SATELLINE radio modems.

CRS-2F	PC	SATELLINE-2ASxE , 3AS-series
CRS-18F	PC	SATELLINE-1870

## 14 EXTENSION MODULES

### General

1... 3 extension modules can be connected to SATEL I-LINK 100 MODBUS. The extension modules must always be connected to I-LINK 100 MODBUS control unit, they do not operate alone.

**I-LINK 200:** 4 digital and 2 analogue inputs and outputs

**I-LINK 300:** 6 digital inputs and outputs

### Assembly

The modules are joined together by connecting the EXTENSION and To EXTENSION connectors as in the picture. The extension modules can be joined in any order. The number of extension modules is 1...3 pcs (I-LINK 100 MODBUS + 1...3 extension modules).

### I-LINK 100 MODBUS

Main module

4 digital

2 analogue I/O-ports

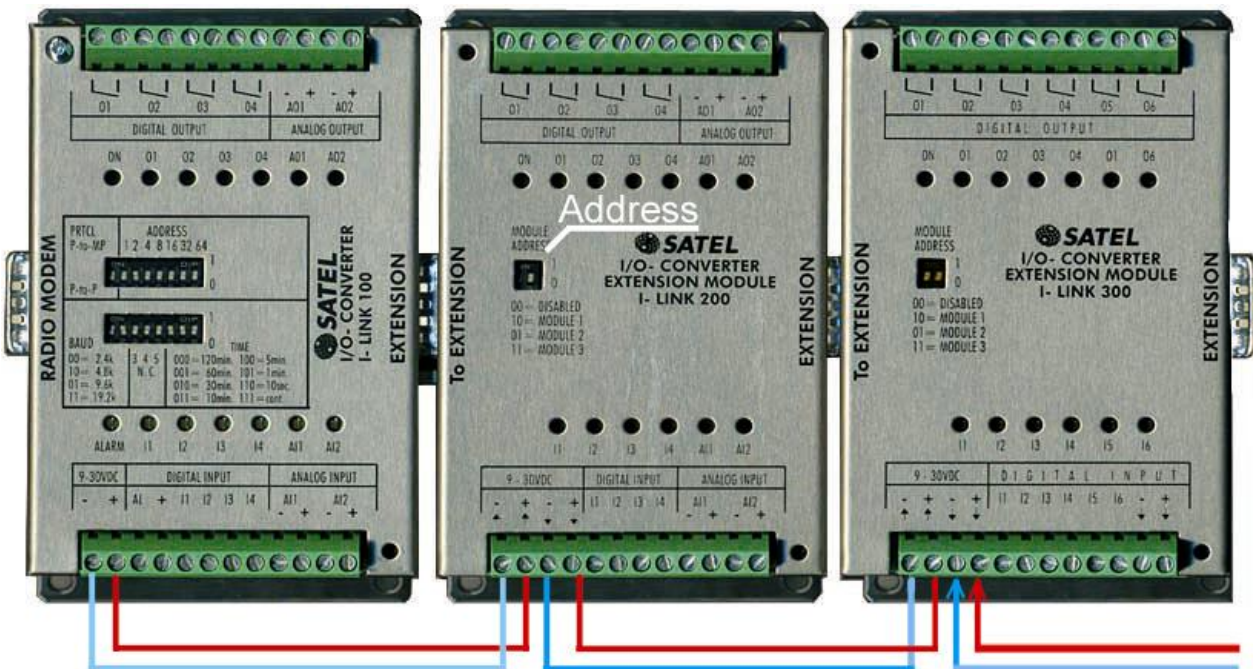
**I-LINK 200** Extension

4 digital

2 analogue I/O-ports

**I-LINK 300** Extension

6 digital I/O-ports



### Connections

The I/O-ports of the extension modules are connected same way as the main unit's I/O-ports. The supply voltage is not linked through the modules, so it must be connected using the green screw contacts. The supply voltage must be connected directly to the I-LINK 100 MODBUS. The I-LINK 100 MODBUS is equipped with an internal fuse (self recovery type), therefore the extension must get the supply voltage from the pin +OUT. If there are many Extension modules the linking can be done what is the most practical for the wire work (see the picture).

### Settings

Extension modules must have different addresses. The address is set by the "Module Address"-switches. The alternatives are: 00=Module not in operation, 01, 10 and 11. The location is shown in the picture as "Address".

## 15 CONNECTION EXAMPLES

Example of one control unit and two sub-stations

