ST11030

10 channels

USER MANUAL

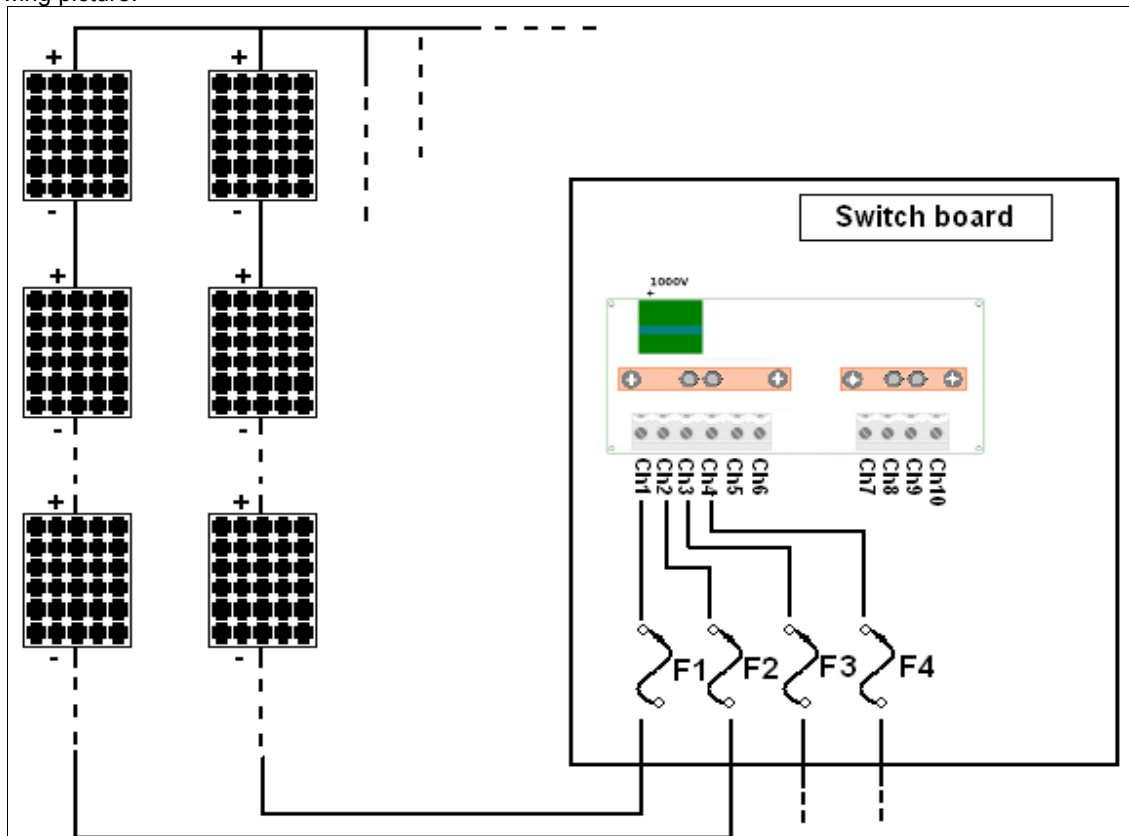rev. 0.4

24th March 2016
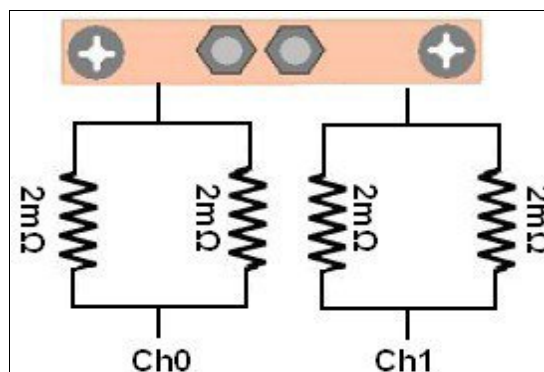
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1.1   Introduction

The ST1 module to string control, allow to monitoring current and voltage generated by photovoltaic panels strings. Typically inside a panels system, each string is composed by 15 ÷ 25 panels connected in series with the positive pole connected to each other. The negative pole of each string is brought to the dedicated input, like in the following picture:

Each channel can read a maximum current of 30A (although typically the current of each string is more or less 7 ÷ 8A). After the strings input connector, on the ST1 board there are two resistors in parallel, they are necessary to detect the current flow:
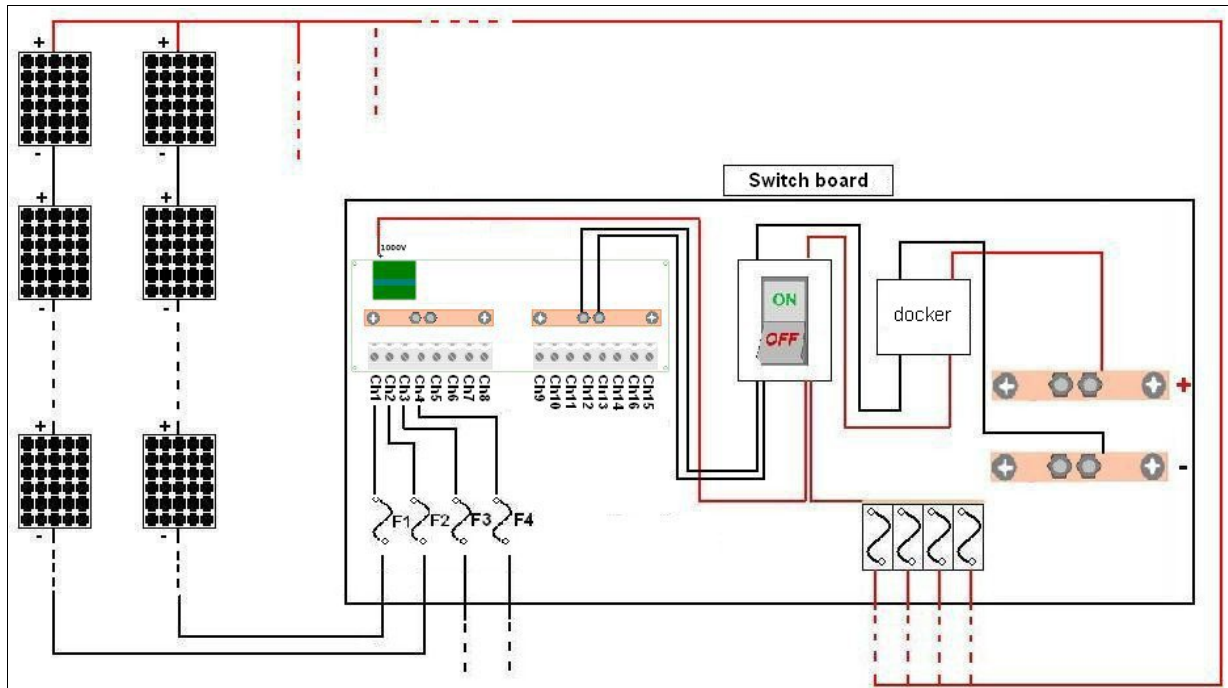

and finally a copper bar connect all the negative poles, <u>thus creating a common 0V</u>.
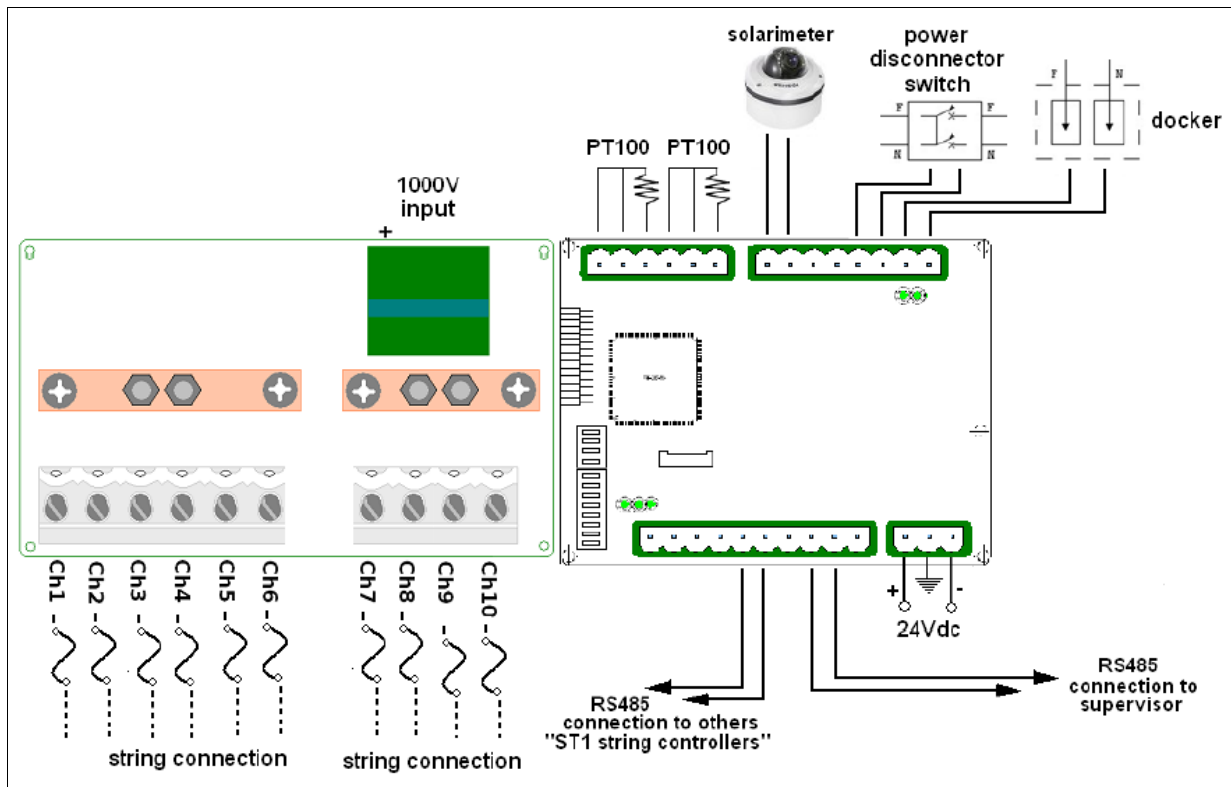The ST1 board also provides two digital inputs and four analog inputs. Two analog inputs are for PT100 connection, one analog input may be 0...100mV or 0...10V (typically for solarimeter connection) and the last analog input will be 0...20mA wuth precision better than 3%. The digital inputs allows to detect the dockers state. Is possible communicate with the ST1 board with an RS485 serial port. Using Modbus RTU protocol, or with

Kernel Sistemi protocol, is possible monitoring all the physical quantities measured (temperature, solar intensity, corrente, digital inputs state etc...).
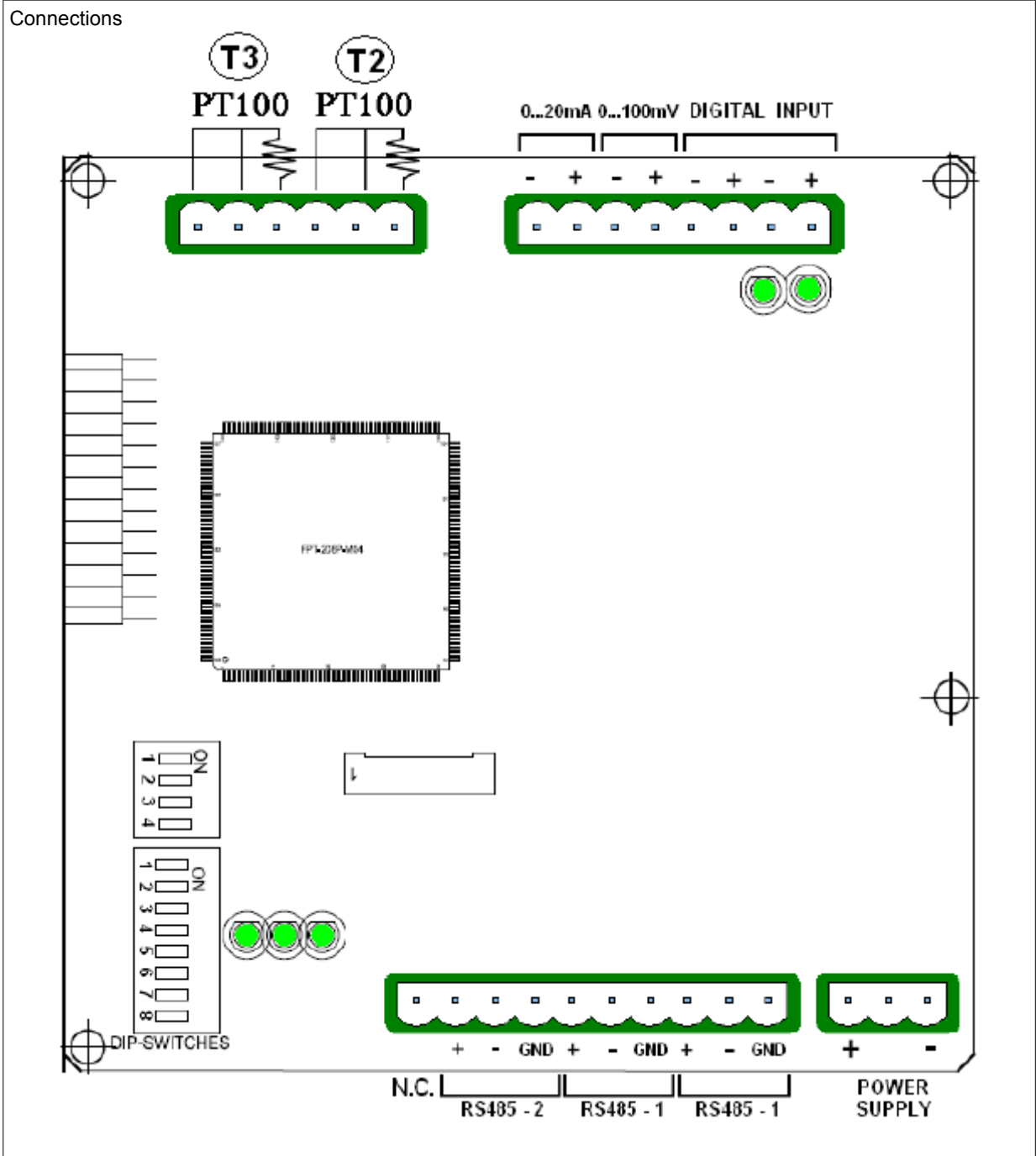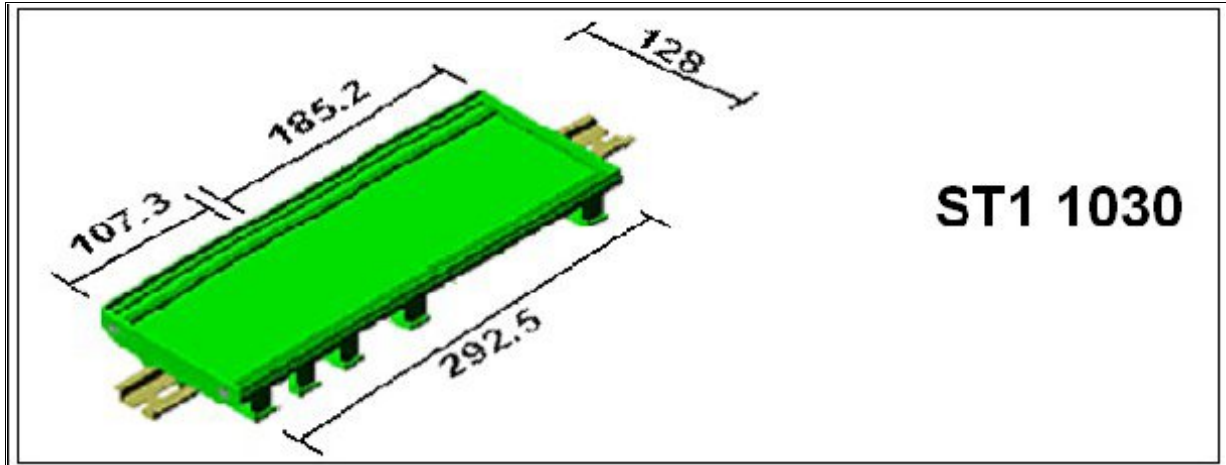

In the following image there is the "ST1 string controller" with all its connections. Obviously isn't necessary connect everything.
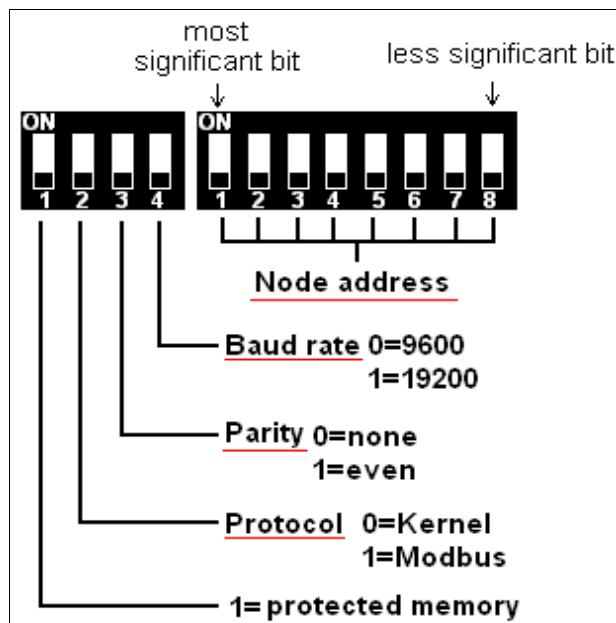
2   **HARDWARE CHARACTERISTICS**

Microprocessor	Fujitsu MB91467 @ 100MHz
Power supply	24Vdc
Power consumption (W)	< 3W
Muximum number of monitored strings	10
Maximum common voltage	1000V with precision better than 3%.
Maximum current for each string	30A
Range of measurement	0...300A
Current reading accuracy	Better than 0,15%
Current reading precision	Typical 0,5%
Communication	Modbus RS485 / RS487
Digital inputs	2
Analog inputs	2 PT100 inputs, 1 current input (0...20mA) and 1 voltage input (0...100mV)
Working temperature's range	From -20 to +70 °C
Working atmosphere	Without corrosive gas
ID Address	Defined by dip-switchs
Size	128 x 292,5mm

N°	Type of resources
2	PT100 inputs (from 0 to 300 °C) to temperature reading, with precision better than 3%.
1	Sensor on board to switch board's temperature reading (precision better than 5%).
1	Analogic input from 0 to 100mV or from 0...10V, typically to solarimeter connection.
1	Auxiliary analogic input from 0 to 20mA with precision better 3%.
2	PNP digital inputs 24Vdc, typically used to docker connection, switchs or other devices.
2	Serial ports RS485. COM1 and COM2. COM1: this serial port is used to connect many "ST1 string controllers" into a network or to a PC. Is possible select the communication characteristics with a dip-switchs on board (node address, baud rate, parity, and communication protocol, that may be Modbus RTU or Kernel). This COM is divided in two connectors in order to facilitate the wiring. COM2: allow to connect Kernel Sistemi I/O expansions modules.
10	This board can manage the current reading of 10 strings with typical precision of 0,5%.

Connections

2.1 Dip-switchs

Some dip-swichs examples:

	Proto.	: Kernel
	Parity	: none
	Baud R.	: 19200
	Addr.	: 4
	Proto.	: Modbus
	Parity	: none
	Baud R.	: 19200
	Addr.	: 1

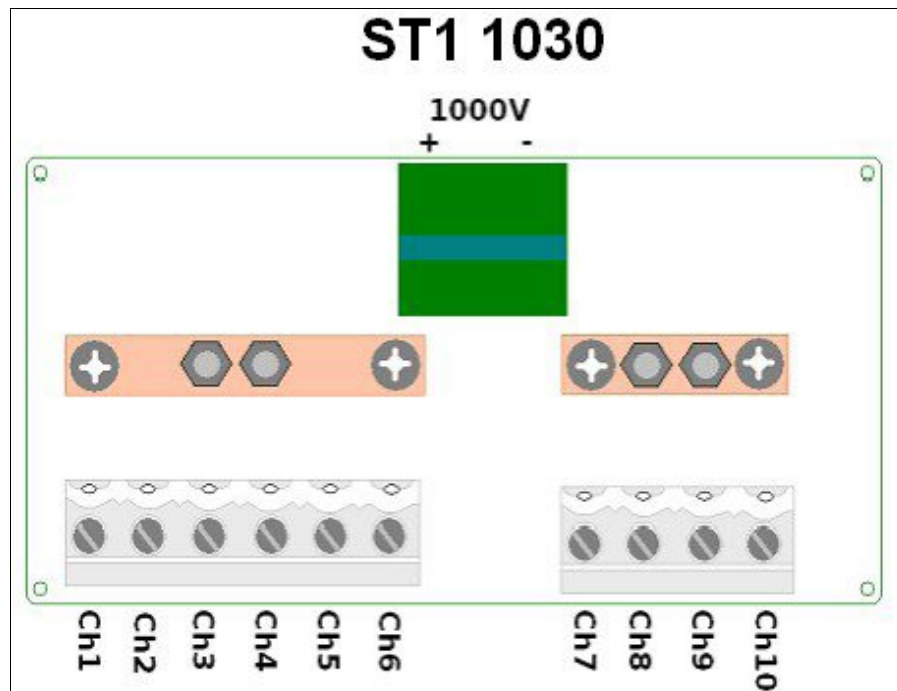## 2.2 Analog inputs

2.3 ST1 1030

2.4   RS485 communication cable

Everything about the RS485 connection, must meet certain features:

Maximum cable length
it must be no longer than 1,2Km (it means the entire line length, and not the conection between two nodes)

Maximum number of slaves
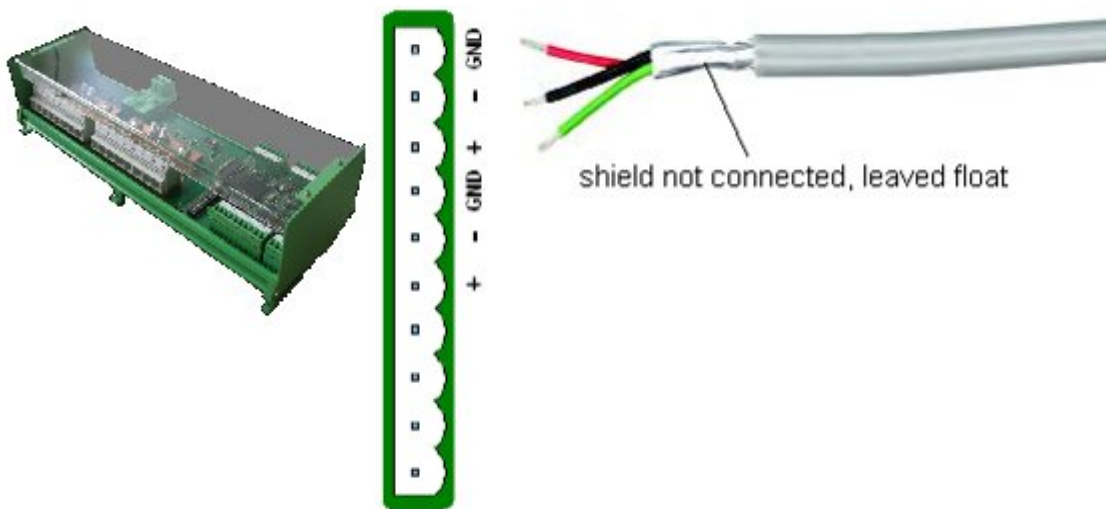it's possible connect up to a maximum of one hundred slaves

Technical characteristics of the cable to use
It must be a three-wire cable 3 x 0.75mm

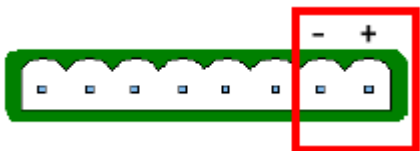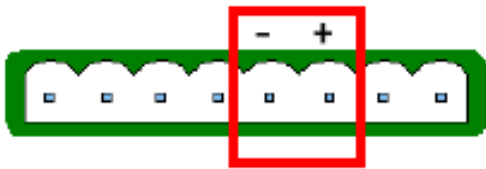_How to do the RS485 connection_
The RS485 connection must be a three wires connection (TX+, TX- and GND) with a shielded cable. The cable shield must be leaved float, it means that the shield must be not connected neither one side nor the other one.

3   **MEMORY MAP**

The ST1 has the following memory map, it's made of 16 bits locations (1word) called "DATA". Because each DATA is è composed by 16 bits, its maximum value will be 65535.

proto.Modbus	proto.Kernel	meaning
DATA.30001	DATA.49	Inputs
DATA.30002	DATA.160	Inst Curr Str_01 (mA [0...30000])
DATA.30003	DATA.161	Inst Curr Str_02 (mA [0...30000])
DATA.30004	DATA.162	Inst Curr Str_03 (mA [0...30000])
DATA.30005	DATA.163	Inst Curr Str_04 (mA [0...30000])
DATA.30006	DATA.164	Inst Curr Str_05 (mA [0...30000])
DATA.30007	DATA.165	Inst Curr Str_06 (mA [0...30000])
DATA.30008	DATA.166	Inst Curr Str_07 (mA [0...30000])
DATA.30009	DATA.167	Inst Curr Str_08 (mA [0...30000])
DATA.30010	DATA.168	Inst Curr Str_09 (mA [0...30000])
DATA.30011	DATA.169	Inst Curr Str_10 (mA [0...30000])

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proto.Modbus	proto.Kernel	meaning
DATA.30034	DATA.192	Single input
DATA.30035	DATA.193	Single input

...

proto.Modbus	proto.Kernel	meaning
DATA.30040	DATA.240	Inst V_1 (V [0...1000])
DATA.30041	DATA.241	Not used
DATA.30042	DATA.242	Aux 1 (0...100mV) [0...1000]
DATA.30043	DATA.243	Aux 2 (0...20mA) [0...1000]
DATA.30044	DATA.244	Inst T_1 (°C [0...100])
DATA.30045	DATA.245	Inst T_2 (°C [-22,0...+83,0])
DATA.30046	DATA.246	Inst T_3 (°C [-22,0...+83,0])

| DATA.30047 | DATA.247 | Sum of all currents (A) |
| DATA.30048 | DATA.248 | Power (W) |

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proto.Modbus	proto.Kernel	meaning
DATA.30052	DATA.192	RMS Curr Str_01 (average value on last 6 seconds)
DATA.30053	DATA.193	RMS Curr Str_02 (average value on last 6 seconds)
DATA.30054	DATA.194	RMS Curr Str_03 (average value on last 6 seconds)
DATA.30055	DATA.195	RMS Curr Str_04 (average value on last 6 seconds)
DATA.30056	DATA.196	RMS Curr Str_05 (average value on last 6 seconds)
DATA.30057	DATA.197	RMS Curr Str_06 (average value on last 6 seconds)
DATA.30058	DATA.198	RMS Curr Str_07 (average value on last 6 seconds)
DATA.30059	DATA.199	RMS Curr Str_08 (average value on last 6 seconds)
DATA.30060	DATA.200	RMS Curr Str_09 (average value on last 6 seconds)
DATA.30061	DATA.201	RMS Curr Str_10 (average value on last 6 seconds)

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proto.Modbus	proto.Kernel	meaning
DATA.40001	DATA.00	Module configuration
DATA.40002	DATA.544	Offset Curr Str_01
DATA.40003	DATA.545	Offset Curr Str_02
DATA.40004	DATA.546	Offset Curr Str_03
DATA.40005	DATA.547	Offset Curr Str_04
DATA.40006	DATA.548	Offset Curr Str_05
DATA.40007	DATA.549	Offset Curr Str_06
DATA.40008	DATA.550	Offset Curr Str_07
DATA.40009	DATA.551	Offset Curr Str_08
DATA.40010	DATA.552	Offset Curr Str_09
DATA.40011	DATA.553	Offset Curr Str_10

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proto.Modbus	proto.Kernel	meaning
DATA.40040	DATA.576	Offset V_1
DATA.40041	DATA.577	Not used
DATA.40042	DATA.578	Offset Aux_1
DATA.40043	DATA.579	Offset Aux_2
DATA.40044	DATA.580	Offset T_1
DATA.40045	DATA.581	Offset T_2
DATA.40046	DATA.582	Offset T_3

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proto.Modbus	proto.Kernel	Kernel Sistemi s.r.l.
		meaning
DATA.40052	**DATA.592**	Gain Curr Str_1
DATA.40053	**DATA.593**	Gain Curr Str_2
DATA.40054	**DATA.594**	Gain Curr Str_3
DATA.40055	**DATA.595**	Gain Curr Str_4
DATA.40056	**DATA.596**	Gain Curr Str_5
DATA.40057	**DATA.597**	Gain Curr Str_6
DATA.40058	**DATA.598**	Gain Curr Str_7
DATA.40059	**DATA.599**	Gain Curr Str_8
DATA.40060	**DATA.600**	Gain Curr Str_9
DATA.40061	**DATA.601**	Gain Curr Str_10

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proto.Modbus	proto.Kernel	*meaning*
DATA.40090	**DATA.624**	Gain V_1
DATA.40091	**DATA.625**	Not used
DATA.40092	**DATA.626**	Gain Aux_1
DATA.40093	**DATA.627**	Gain Aux_2
DATA.40094	**DATA.628**	Gain T_1
DATA.40095	**DATA.629**	Gain T_2
DATA.40096	**DATA.630**	Gain T_3

Notes:
Each "offset DATA" has 0 as default value. Each "gain DATA" has 1000 as default value. *The value 1000 means x1*, in this way, for example, is possible write 500 and make the value **x0,5.**