SNV047EC.X

Combiner Box Card

User and Installation Manual

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Document Follow-up

Action	Name	Function	Date	Signature
Written by:	Alexandros Karakasis	Engineer	14/10/2015	
Verified by:	Vaidakis Michael	General Director	04/12/2015	
Verified by:				

Versions

Indices	Date	Modification
V1.0	04/12/2015	Initial version.
V1.1	01/03/2016	minor document updates

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Description

Overview

SNV047EC is a “combiner box” card with dc current, voltage measurement and three digital input. It is designed to be used in photovoltaic parks with central inverters in order to connect in parallel strings and monitor string currents and voltage.

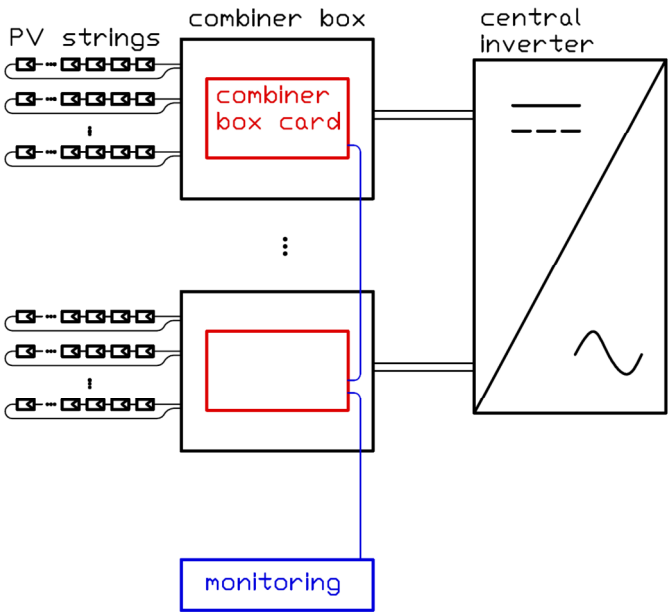

Figure 1: SNV047EC Topology Diagram.

It has appropriate board shape to direct connect to DIN rail fuse holders, avoiding extra cabling and material costs. Current collector bars are pre-mounted and designed to be directly connected to the disconnector switch for a simpler and cost efficient installation. Negative collector bar can be also provided.

Current measurement is performed on the positive side. Shunt resistors are used and voltage drop on them is amplified through amplifiers and then sampled and processed by a 32bit CORTEX-M3 microcontroller at 96MHz.

The microcontroller can deliver measurements through an isolated serial RS485 bus transceiver using Modbus protocol. It can also hold values, in order to perform simultaneous measurements through all the cards in a bus and then retrieve all the measurements. The microcontroller is also calculating the average of voltage, currents and current square values, with 347Hz sampling for each channel. The averaging period is indicated-marked by a master controller

broadcast command. Averaged values of different cards are synchronized and then collected. Bandwidth consumption on the bus is limited, giving the ability for a prompt response of the rest requests.

Three contact inputs are also implemented in order to monitor other component like the condition of an SPD. Board temperature is also measured and provided.

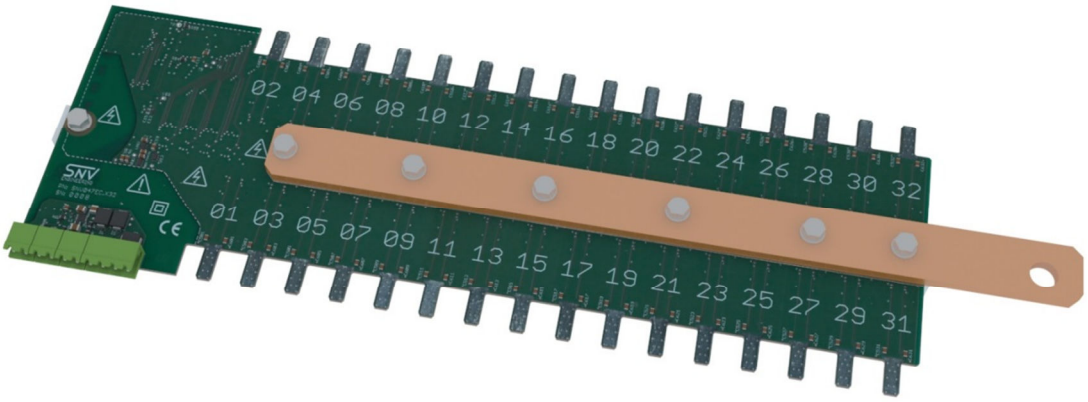

Figure 2: SNV047EC image

Features

The SNV047EC offers the following (see also specification tables):

- 16, 24 or 32 channels (any pair number up to 32 channels on request).
- board shape to collaborate with DIN rail fuse holders.
- on board positive current collector bar ready to connect to disconnection switch .
- independent DC current measurements per channel at positive side.
- 0 - 10A current measurement range (other ranges are available on demand). 16A/channel ampacity for entire operating temprature range.
- 0 – 1000V voltage measurement.
- very low sensing resistance on measurement channels: 3mΩ.
- system voltage up to 1000Vdc.
- 347Hz sampling per channel.
- 3 dry contact inputs.
- temperature measurement on board with high accurancy.
- on board long time averaging and integrations.
- communication using MODBUS over RS485.
- board low power consumption < 1W.
- Operating temperatures : -40°C to +75°C (up to +85°C on request).
- 32bit ARM CORTEX-M3 microcontroller @ 96MHz.
- CE: EMC: EN61326-1 and Safety: EN61010-1.
- ANSI/UL61010-1 (file number E464243)

Specifications

Electrical Characteristics

	note	min	nom	max	Unit
Power supply	Absolute	18	24	26	V dc
Consumption:	Note 1, 2 Abs. Max	40	30	25	mA
Measurement channel resistance	each			3	mOhm
Channel maximum current		-16		16	A
Channel max working voltage	Note 3			1000	V dc
Current measurement range	Note 4, 5	0.035	-	10	A
Voltage measurement range		0	-	1000	V

Note 1: The value is for each installed board.
Note 2: The maximum number of cards to be installed in series is 127.
Note 3: Equipment pollution degree 2.
Note 4: Current values lower than 75mA are pulled down to zero.
Note 5: The provided measurement range is for the entire operating temperature range.

Physical & Environmental Characteristics

	Details
Operating Temperature	-40 °C to +75 °C (see Note 6 & 7)
Storage Temperature	-40 °C to +100 °C
Relative Humidity	up to 95% non condesing
Operating Altitude	bellow 2000m
Board Dimensions (see also annex A)	16 Channels: LxWxH = 238 x 122 x 28 mm 24 Channels: LxWxH = 284 x 122 x 28 mm 32 Channels: LxWxH = 356 x 122 x 28 mm
EMC – Emissions	Meets: EN 61326-1, EN 61000-6-3, EN 50081-1, EN 55011(Class A ITE)
EMC – Immunity	Meets: EN 61326-1, EN 50082-1, EN61000-4-3 (Radiated EM fields immunity) EN61000-4-4 (Fast transient burst (EFT)) EN61000-4-5 (Surges) EN61000-4-6 (Conducted EM fields immunity)
Safety	Meets IEC61010-1(ed.3),IEC61010-2-030(ed.1)
Measurement Category	CAT 0
Transient Overvoltage	rated for 1,5kV
Pollution degree	2
Usage	Indoor or outdoor use installed in a metallic and/or plastic box

Note 6: Terminal blocks should not be plugged or unplugged below -30°C.
Note 7: Extended operating temperature range up to +85°C on request.

Measurement Specifications

		Details
Averaging	max averaging time	25 days at 347Hz sampling
Current measurement	measurement range	0.035 to 10 A (see Note 8)
	measurement accuracy	0.5% reading + 0.5%range (10A)
	ADC resolution (12bit)	2.5mA
	thermal Drift on board compensated	0.4% / °C
	calibration current	at 5.5 A
Voltage measurement	measurement range	0 to 1000 V
	measurement accuracy	better than 0.5%
	ADC resolution (12bit)	0.25 V
	calibration voltage	700 V
on board Temperature measurement	measurement range	-55°C to +125°C
	measurement accuracy	±0.5°C (typical) at +25°C
		±1°C (max) from -10°C to +80°C
		±2°C (max) from -10°C to +125°C
		±3°C (max) from -55°C to +125°C

Note 8: Other current measurement ranges are available on request.

Communications and bus Specifications

Hardware layer	RS485
Communication Protocol	Modbus RTU
Default baud rate	9600 bps (see Note 9)
Max number of nodes	128
Max suggested cable length	1200 m
Protected from Overvoltage Line Faults	yes
Bus Short-Circuit Protection	yes

Note 9: Other baud rates up to 250 kbps are set on request.

Layout

The card is separated in two main areas.

The one, as shown in the following figure red, is dedicated to the measurement of the current passing through the card, voltage measurement and it is connected to the positive and negative collector bars and to the positive side fuse holders. This area is a high voltage area, where voltage is up to 1000Vdc exist.

CAUTION

To the card will be connected high voltage signals (up to 1000Vdc)

The operation and installation of the card is considered to be done from qualified personnel

The high voltage area is marked on PCB with a dash line. All area inside dash line is in high voltage (up to 1000V dc).

The area shown at the following figure green, is the low voltage area. The Modbus interface and card power supply are connected to this area.

The low voltage and high voltage areas are separated by an isolation area.

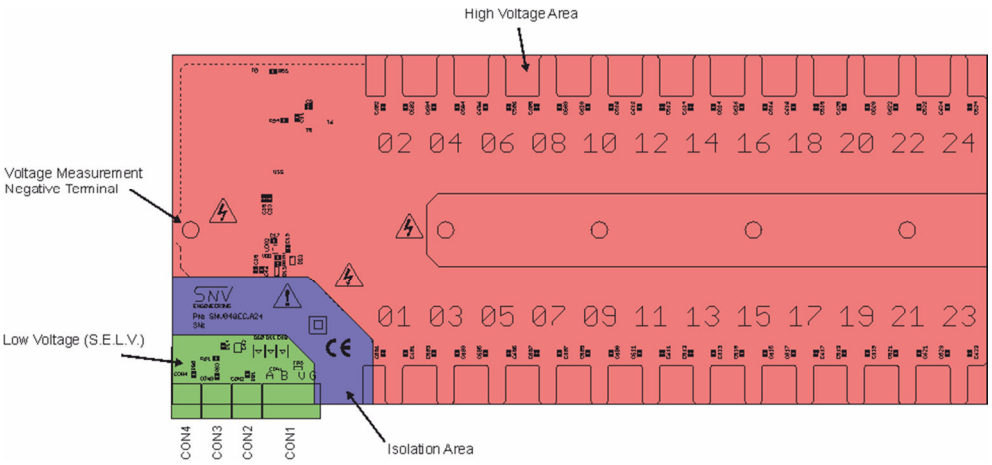

Figure 3: SNV047EC Topology Diagram.

The SNV047EC uses the connectors CON1 to connect to the bus and power supply (see table 1).

Connector CON2, CON3 and CON4 has two pins each to connect a dry contact (switch). They are used to monitor a disconnectror position or status, a limit switch or similar signal (ex. surge protection, door opening, disconnector trip etc.).

CAUTION

At the connectors CON1, CON2, CON3, and CON4 should be connected only to safety extra low voltage systems.

The connections for the connectors CON1-4 are listed in the table 1.

Connector	Pin Number	Description	Comments
CON2,3,4	Pin 1	Pin1	Dry contact input
	Pin 2	Pin2	
CON1	Pin 4	BUS A	TxD+/RxD+
	Pin 3	BUS B	TxD-/RxD-
	Pin 2	VCC	24Vdc
	Pin 1	GND	Ground

Table 1: Connectors Description

The connector plugs used are equivalent to the ones listed in the following table:

Connector Ref	Manufacturer	Manufacturer P/N
For CON1	FCI	20020006-H041B01LF
For CON2-4	FCI	20020006-H021B01LF

Table 2: Connectors Description

Ordering Information

Listed below are part numbers for the SNV047EC and available accessories.

Cards are provided with collector bars mounted and mounting bars as a whole. Separate part numbers for collector bars and mounting bars are provided only for replacements.

SNV047EC.A16	16 current measurement channels
SNV047EC.A24	24 current measurement channels
SNV047EC.A28	28 current measurement channels
SNV047EC.A32	32 current measurement channels
SNV047EC.X##	Custom versions (could be different measurement range, etc)

Table 3: Ordering information

X: is the hardware version

Safety instructions

The Combiner Box Card, SNV047EC is designed and manufactured to be functionally safe for persons who operate or service it. Potential hazards are addressed by a combination of careful system design and appropriate warning labels.

However, during its operation, high voltages apply on the card. As a consequence, the card is capable of causing serious personnel injury and damage to equipment, if installed, operated, or serviced improperly.

CAUTION

To the card will be connected high voltage signals (up to 1000Vdc)

The installation is considered to be done from qualified personnel

The card should be installed in such a way that there is no access to it by hand neither from the cables part nor from any other place

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CAUTION

The card must be installed following the below restrictions:

>= 10mmgap from grounded plates

>= 20mm gap from non-grounded plates

<u>Note:</u> The gap is defined as the distance between relevant plate, or other element and the card routes, or components' pins, or the highest component mounted on the card, including any other conducting element, like bolts, nuts, bar, cables and cable terminals fixed on the card

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SNV does not assume liability for the customer's failure to comply with established procedures. Read this chapter before you perform any operations or installation of the card.

If the equipment used in a manner not specified by the instructions of user manual, the protection provided by the card may be impaired.

SNV's equipment is designed to, and reviewed, against to CE Safety and EMC standards. These standards incorporate applicable electrical codes and safety regulations.

This manual contains information and warnings which users must follow for safe operation and to keep the apparatus in safe condition.

Even when the apparatus is not connected to its power supply, terminals can be electrically live, and the opening of covers or removal of parts is likely to expose live parts.

The card must be disconnected from all voltage sources before it is disassembled for any adjustment, replacement, maintenance, or repair.

For USA/Canada the provided equipment is to be employed in accordance with ANSI/NFPA 70, National Electrical Code (NEC); designed to be installed in accordance with the Canadian Electrical Code (CEC), Part I, CSA C22.1, and CSA C22.2 No. 0; or designed to comply with both the NEC and CEC.

The following symbols appear in various places on the card to call your attention to hazards or to indicate that you should consult the manuals for further information.

Safety Symbols

Double insulation or reinforced insulation.

CAUTION RISK OF ELECTRIC SHOCK

CAUTION RISK OF DANGER

Note When an equipment is marked with this symbol the documentation must always be consulted, in order to find out the nature of the potential HAZARD and any actions which have to be taken

Installation

Overview

The below installation procedure is proposed by SNV Engineering in order to ensure the good and safe operation of the card.

In case that the described procedure is not followed, SNV Engineering is not responsible from any caused damages or injury.

Card has DC current measurement channels with current output terminal common.

CAUTION

To the card will be connected high voltage signals (up to 1000Vdc)

The installation is considered to be done from qualified personnel

The card should be installed in such a way that there is no access to it by hand neither from the cables part nor from any other place

CAUTION

The card must be installed following the below restrictions:

>= 10mm gap from grounded plates

>= 20mm gap from non-grounded plates

<u>Note:</u> The gap is defined as the distance between relevant plate, or other element and the card routes, or components' pins, or the highest component mounted on the card, including any other conducting element, like bolts, nuts, bar, cables and cable terminals fixed on the card

Connector CON2, CON3 and CON4 are dry contact inputs, having two states depending the contact of the connector's two pins or not.

CAUTION

No voltage should be applied to any of the two pins of CON2, CON3 and CON4

For USA/Canada the provided equipment is to be employed in accordance with ANSI/NFPA 70, National Electrical Code (NEC); designed to be installed in accordance with the Canadian Electrical Code (CEC), Part I, CSA C22.1, and CSA C22.2 No. 0; or designed to comply with both the NEC and CEC.

Communication bus and power supply provision

Card uses RS485 bus for data communication. Cards are connected to the bus in series using twisted pair cable.

It is suggested to connect all cards in series in a “line”, preferable with the master controller in the middle. If not convenient a star topology, with the master controller in the center, may work depending of the cable length, the number of the lines, and their relative lengths. In any case all the terminal nodes must be terminated with the appropriate resistor. Bias resistors also must be installed.

RS485 transceiver used supports up to 128 nodes; hence up to 127 boards can be connected to the same bus. The total length of the cable used for the boards interconnection is suggested not to exceed 1200m, when bus repeaters are not used.

The same cable can be used for the power supply of the cards, using an extra pair. The power supply source should be 24Vdc and the current capacity should not exceed 5A. The card has power supply inverse polarity protection.

Inspection and handling

Visually inspect the Card before installing it, for any defect or damage.

Immediately notify the carrier if any damage is apparent.

CAUTION

Proper ESD handling procedures must always be used when packing, unpacking or installing the card. Failure to do so may cause damage to the unit.

Preparation

Card mounting and support

Card is mounted through DIN rail fuse holders and card collector bar mounted on the switch or another spacer. Caution must be paid to not distort the card and to not transfer any stress to it. Fuse holder and switch level must be set properly.

For the installation and materials applied the following specifications should at least comply:

- ensure following gap, defined as the distance between relevant plate, or other element and the card routes, or components' pins, or the highest component mounted on the card, including any other conducting element, like bolts, nuts, bar, cables and cable terminals fixed on the card.

  >= 10mm gap from grounded plates

  >= 20mm gap from non-grounded plates
- ensure dielectric strength >3.5kV
- ensure flammability rating better than 94V1.
- ensure operating temperature range and aging strength depending application specifications.

The provided materials by SNV comply with the above.

Voltage measurement is conducted using as a negative voltage terminal the M5 bolt adjacent to the collection bar on the card shown on the following figure. Use an appropriate ring terminal to connect to it.

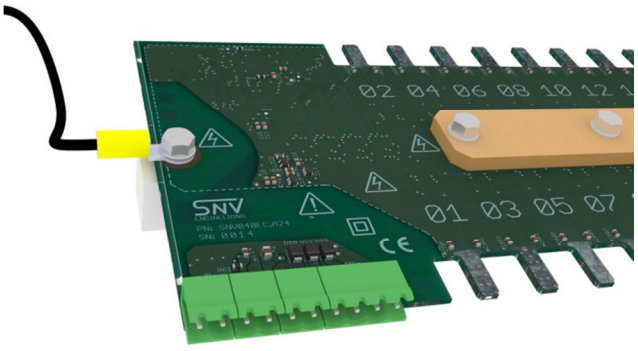


Figure 4: SNV047EC Voltage measurement negative terminal connection.

All M5 bolts must be tight with torque 3-4 Nm, to ensure the conductivity. Use plain washer (DIN125) and above lock washer (DIN127) between ring terminal or common bar and bolt head. Do not apply lock washer directly on the card.

Cables and fuses

The cables should be properly selected and sized according to the application specifications. Voltage must not exceed 1000VDC. A **fuse 10x38 gPV type** must be installed, with rated current up to 16A and appropriate voltage rating.

CAUTION

Voltage must not exceed 1000VDC. A fuse must be installed for each current measurement channel separately, with rated current up to 16A.

For the preparation of the cables connected to the current channels the IPC-620 have to be followed by the installer.

The cable should be connected to the voltage measurement negative terminal using ring terminal and lock washer above the ring terminal.

CAUTION

Cables to be connected to the card terminals may exceed 60°C. Temperature rating of the cables to be connected to the card terminals must be determined accordingly.

The provided “combiner box card” is intended to be installed in an enclosure in a “combiner box” product. Depending current rating, enclosure shape, size, material and design, temperature rise occur. Cable temperature rating must be set accordingly by the installer of the card and designer of the combiner box. Indicatively, for 9A per channel operation in all channels, temperature rise of the order of 30 Celsius grad inside the enclosure can be observed. Should that be a restriction, end product designer, can consider, current derating and/or operating temperature derating.

Connectors plug preparation

The connector plugs to be used are those listed in table 2 or equivalent.

For the preparation of the cables connected to the plugs the IPC-620 have to be followed by the installer.

Plugs should be connected with cables while unplugged.

Dimensions

08 Channels: LxWxH = 140 x 122 x 28 mm
16 Channels: LxWxH = 238 x 122 x 28 mm
24 Channels: LxWxH = 284 x 122 x 28 mm
28 Channels: LxWxH = 320 x 122 x 28 mm
32 Channels: LxWxH = 356 x 122 x 28 mm

Operation

Communication and Monitoring

For communication, MODBUS protocol over an RS485 serial line is implemented (RTU mode @9600bps). See further “MODBUS Application Protocol Specification v1.1b” and “MODBUS over Serial Line Specification and Implementation Guide v1.02”.

Data can be read through “16bit input registers”. Commands are send by writing “Holding registers”. Three commands are implemented: “hold”, “mark” and “change address”. Hold command transfer “instant” values to “holded values”. Command can be send with a broadcast write, acquiring a snapshot of all the currents from all the cards in the bus.

Mark command initiates averaging, at the same time terminates previous averaging and transfers the result to the relevant registers. It is suggested to broadcast periodically the “mark” command, with the desired period (as for example 10 mins), and during each period read and store the averaged data. “Mark” command may be applied individually to allow for each card to acknowledge. In case that “mark” command is broadcasted, time elapsed since last “mark” on each card is available (see modbus memory map bellow) in order to check proper transmission.

Modbus Memory Map

The memory map of the card is describing in the following table. Note that returned values for a channel not present on a hardware version may be invalid.

16bit input registers (modbus function code 4)					
address		type	units	description	channel
dec	hex				
0	0x 000	float	Amperes	instant current	1
1	0x 001				
2	0x 002	float	Amperes		2
3	0x 003				
4	0x 004	float	Amperes		3
5	0x 005				
6	0x 006	float	Amperes		4
7	0x 007				
8	0x 008	float	Amperes		5
9	0x 009				
10	0x 00A	float	Amperes		6
11	0x 00B				
12	0x 00C	float	Amperes		7
13	0x 00D				
14	0x 00E	float	Amperes		8
15	0x 00F				
16	0x 010	float	Amperes		9

17	0x 011				
18	0x 012	float	Amperes		10
19	0x 013				
20	0x 014	float	Amperes		11
21	0x 015				
22	0x 016	float	Amperes		12
23	0x 017				
24	0x 018	float	Amperes		13
25	0x 019				
26	0x 01A	float	Amperes		14
27	0x 01B				
28	0x 01C	float	Amperes		15
29	0x 01D				
30	0x 01E	float	Amperes		16
31	0x 01F				
32	0x 020	float	Amperes		17
33	0x 021				
34	0x 022	float	Amperes		18
35	0x 023				
36	0x 024	float	Amperes		19
37	0x 025				
38	0x 026	float	Amperes		20
39	0x 027				
40	0x 028	float	Amperes		21
41	0x 029				
42	0x 02A	float	Amperes		22
43	0x 02B				
44	0x 02C	float	Amperes		23
45	0x 02D				
46	0x 02E	float	Amperes		24
47	0x 02F				
48	0x 030	float	Amperes		25
49	0x 031				
50	0x 032	float	Amperes		26
51	0x 033				
52	0x 034	float	Amperes		27
53	0x 035				
54	0x 036	float	Amperes		28
55	0x 037				
56	0x 038	float	Amperes		29
57	0x 039				
58	0x 03A	float	Amperes		30
59	0x 03B				
60	0x 03C	float	Amperes		31
61	0x 03D				
62	0x 03E	float	Amperes		32
63	0x 03F				
64	0x 040	float	Amperes	current averaged	1
65	0x 041				
66	0x 042	float	Amperes		2
67	0x 043				
68	0x 044	float	Amperes		3
69	0x 045				
70	0x 046	float	Amperes		4
71	0x 047				
72	0x 048	float	Amperes		5
73	0x 049				
74	0x 04A	float	Amperes		6

75	0x 04B				
76	0x 04C	float	Amperes		7
77	0x 04D				
78	0x 04E	float	Amperes		8
79	0x 04F				
80	0x 050	float	Amperes		9
81	0x 051				
82	0x 052	float	Amperes		10
83	0x 053				
84	0x 054	float	Amperes		11
85	0x 055				
86	0x 056	float	Amperes		12
87	0x 057				
88	0x 058	float	Amperes		13
89	0x 059				
90	0x 05A	float	Amperes		14
91	0x 05B				
92	0x 05C	float	Amperes		15
93	0x 05D				
94	0x 05E	float	Amperes		16
95	0x 05F				
96	0x 060	float	Amperes		17
97	0x 061				
98	0x 062	float	Amperes		18
99	0x 063				
100	0x 064	float	Amperes		19
101	0x 065				
102	0x 066	float	Amperes		20
103	0x 067				
104	0x 068	float	Amperes		21
105	0x 069				
106	0x 06A	float	Amperes		22
107	0x 06B				
108	0x 06C	float	Amperes		23
109	0x 06D				
110	0x 06E	float	Amperes		24
111	0x 06F				
112	0x 070	float	Amperes		25
113	0x 071				
114	0x 072	float	Amperes		26
115	0x 073				
116	0x 074	float	Amperes		27
117	0x 075				
118	0x 076	float	Amperes		28
119	0x 077				
120	0x 078	float	Amperes		29
121	0x 079				
122	0x 07A	float	Amperes		30
123	0x 07B				
124	0x 07C	float	Amperes		31
125	0x 07D				
126	0x 07E	float	Amperes		32
127	0x 07F				
128	0x 080	float	Amperes	current squared averaged	1
129	0x 081				
130	0x 082	float	Amperes		2
131	0x 083				
132	0x 084	float	Amperes		3

133	0x 085				
134	0x 086	float	Amperes		4
135	0x 087				
136	0x 088	float	Amperes		5
137	0x 089				
138	0x 08A	float	Amperes		6
139	0x 08B				
140	0x 08C	float	Amperes		7
141	0x 08D				
142	0x 08E	float	Amperes		8
143	0x 08F				
144	0x 090	float	Amperes		9
145	0x 091				
146	0x 092	float	Amperes		10
147	0x 093				
148	0x 094	float	Amperes		11
149	0x 095				
150	0x 096	float	Amperes		12
151	0x 097				
152	0x 098	float	Amperes		13
153	0x 099				
154	0x 09A	float	Amperes		14
155	0x 09B				
156	0x 09C	float	Amperes		15
157	0x 09D				
158	0x 09E	float	Amperes		16
159	0x 09F				
160	0x 0A0	float	Amperes		17
161	0x 0A1				
162	0x 0A2	float	Amperes		18
163	0x 0A3				
164	0x 0A4	float	Amperes		19
165	0x 0A5				
166	0x 0A6	float	Amperes		20
167	0x 0A7				
168	0x 0A8	float	Amperes		21
169	0x 0A9				
170	0x 0AA	float	Amperes		22
171	0x 0AB				
172	0x 0AC	float	Amperes		23
173	0x 0AD				
174	0x 0AE	float	Amperes		24
175	0x 0AF				
176	0x 0B0	float	Amperes		25
177	0x 0B1				
178	0x 0B2	float	Amperes		26
179	0x 0B3				
180	0x 0B4	float	Amperes		27
181	0x 0B5				
182	0x 0B6	float	Amperes		28
183	0x 0B7				
184	0x 0B8	float	Amperes		29
185	0x 0B9				
186	0x 0BA	float	Amperes		30
187	0x 0BB				
188	0x 0BC	float	Amperes		31
189	0x 0BD				
190	0x 0BE	float	Amperes		32

191	0x 0BF				
192	0x 0C0	float	Amperes	current holded values	1
193	0x 0C1				
194	0x 0C2	float	Amperes		2
195	0x 0C3				
196	0x 0C4	float	Amperes		3
197	0x 0C5				
198	0x 0C6	float	Amperes		4
199	0x 0C7				
200	0x 0C8	float	Amperes		5
201	0x 0C9				
202	0x 0CA	float	Amperes		6
203	0x 0CB				
204	0x 0CC	float	Amperes		7
205	0x 0CD				
206	0x 0CE	float	Amperes		8
207	0x 0CF				
208	0x 0D0	float	Amperes		9
209	0x 0D1				
210	0x 0D2	float	Amperes		10
211	0x 0D3				
212	0x 0D4	float	Amperes		11
213	0x 0D5				
214	0x 0D6	float	Amperes		12
215	0x 0D7				
216	0x 0D8	float	Amperes		13
217	0x 0D9				
218	0x 0DA	float	Amperes		14
219	0x 0DB				
220	0x 0DC	float	Amperes		15
221	0x 0DD				
222	0x 0DE	float	Amperes		16
223	0x 0DF				
224	0x 0E0	float	Amperes		17
225	0x 0E1				
226	0x 0E2	float	Amperes		18
227	0x 0E3				
228	0x 0E4	float	Amperes		19
229	0x 0E5				
230	0x 0E6	float	Amperes		20
231	0x 0E7				
232	0x 0E8	float	Amperes		21
233	0x 0E9				
234	0x 0EA	float	Amperes		22
235	0x 0EB				
236	0x 0EC	float	Amperes		23
237	0x 0ED				
238	0x 0EE	float	Amperes		24
239	0x 0EF				
240	0x 0F0	float	Amperes		25
241	0x 0F1				
242	0x 0F2	float	Amperes		26
243	0x 0F3				
244	0x 0F4	float	Amperes		27
245	0x 0F5				
246	0x 0F6	float	Amperes		28
247	0x 0F7				
248	0x 0F8	float	Amperes		29

249	0x 0F9				
250	0x 0FA	float	Amperes		30
251	0x 0FB				
252	0x 0FC	float	Amperes		31
253	0x 0FD				
254	0x 0FE	float	Amperes		32
255	0x 0FF				
256	0x 100	float	Celcious	temperature	
257	0x 101				
258	0x 102	float	Volt	system voltage	
259	0x 103				
260	0x 104	float	Volt	system voltage averaged value	
261	0x 105				
262	0x 106	float	Volt	system voltage holded value	
263	0x 107				
264	0x 108	float	kWatt	instant total power	
265	0x 109				
266	0x 10A	float	kWatt	averaged total power	
267	0x 10B				
268	0x 10C	float	kWatt	holded total power	
269	0x 10D				
270	0x 10E	float	kWH	total energy Of last period	
271	0x 10F				
272	0x 110	unsigned long int	csec	time of last period	
273	0x 111				
274	0x 112	unsigned long int	csec	time since last mark	
275	0x 113				
320	0x 140	float	kWatt	instant power	1
321	0x 141				
322	0x 142	float	kWatt		2
323	0x 143				
324	0x 144	float	kWatt		3
325	0x 145				
326	0x 146	float	kWatt		4
327	0x 147				
328	0x 148	float	kWatt		5
329	0x 149				
330	0x 14A	float	kWatt		6
331	0x 14B				
332	0x 14C	float	kWatt		7
333	0x 14D				
334	0x 14E	float	kWatt		8
335	0x 14F				
336	0x 150	float	kWatt		9
337	0x 151				
338	0x 152	float	kWatt		10
339	0x 153				
340	0x 154	float	kWatt		11
341	0x 155				
342	0x 156	float	kWatt		12
343	0x 157				
344	0x 158	float	kWatt		13
345	0x 159				
346	0x 15A	float	kWatt		14
347	0x 15B				

348	0x 15C	float	kWatt		15
349	0x 15D				
350	0x 15E	float	kWatt		16
351	0x 15F				
352	0x 160	float	kWatt		17
353	0x 161				
354	0x 162	float	kWatt		18
355	0x 163				
356	0x 164	float	kWatt		19
357	0x 165				
358	0x 166	float	kWatt		20
359	0x 167				
360	0x 168	float	kWatt		21
361	0x 169				
362	0x 16A	float	kWatt		22
363	0x 16B				
364	0x 16C	float	kWatt		23
365	0x 16D				
366	0x 16E	float	kWatt		24
367	0x 16F				
368	0x 170	float	kWatt		25
369	0x 171				
370	0x 172	float	kWatt		26
371	0x 173				
372	0x 174	float	kWatt		27
373	0x 175				
374	0x 176	float	kWatt		28
375	0x 177				
376	0x 178	float	kWatt		29
377	0x 179				
378	0x 17A	float	kWatt		30
379	0x 17B				
380	0x 17C	float	kWatt		31
381	0x 17D				
382	0x 17E	float	kWatt		32
383	0x 17F				
384	0x 180	float	kWatt	power averaged values	1
385	0x 181				
386	0x 182	float	kWatt		2
387	0x 183				
388	0x 184	float	kWatt		3
389	0x 185				
390	0x 186	float	kWatt		4
391	0x 187				
392	0x 188	float	kWatt		5
393	0x 189				
394	0x 18A	float	kWatt		6
395	0x 18B				
396	0x 18C	float	kWatt		7
397	0x 18D				
398	0x 18E	float	kWatt		8
399	0x 18F				
400	0x 190	float	kWatt		9
401	0x 191				
402	0x 192	float	kWatt		10
403	0x 193				
404	0x 194	float	kWatt		11
405	0x 195				

406	0x 196	float	kWatt		12
407	0x 197				
408	0x 198	float	kWatt		13
409	0x 199				
410	0x 19A	float	kWatt		14
411	0x 19B				
412	0x 19C	float	kWatt		15
413	0x 19D				
414	0x 19E	float	kWatt		16
415	0x 19F				
416	0x 1A0	float	kWatt		17
417	0x 1A1				
418	0x 1A2	float	kWatt		18
419	0x 1A3				
420	0x 1A4	float	kWatt		19
421	0x 1A5				
422	0x 1A6	float	kWatt		20
423	0x 1A7				
424	0x 1A8	float	kWatt		21
425	0x 1A9				
426	0x 1AA	float	kWatt		22
427	0x 1AB				
428	0x 1AC	float	kWatt		23
429	0x 1AD				
430	0x 1AE	float	kWatt		24
431	0x 1AF				
432	0x 1B0	float	kWatt		25
433	0x 1B1				
434	0x 1B2	float	kWatt		26
435	0x 1B3				
436	0x 1B4	float	kWatt		27
437	0x 1B5				
438	0x 1B6	float	kWatt		28
439	0x 1B7				
440	0x 1B8	float	kWatt		29
441	0x 1B9				
442	0x 1BA	float	kWatt		30
443	0x 1BB				
444	0x 1BC	float	kWatt		31
445	0x 1BD				
446	0x 1BE	float	kWatt		32
447	0x 1BF				
448	0x 1C0	float	kWatt	power holded values	1
449	0x 1C1				
450	0x 1C2	float	kWatt		2
451	0x 1C3				
452	0x 1C4	float	kWatt		3
453	0x 1C5				
454	0x 1C6	float	kWatt		4
455	0x 1C7				
456	0x 1C8	float	kWatt		5
457	0x 1C9				
458	0x 1CA	float	kWatt		6
459	0x 1CB				
460	0x 1CC	float	kWatt		7
461	0x 1CD				
462	0x 1CE	float	kWatt		8
463	0x 1CF				

464	0x 1D0	float	kWatt		9
465	0x 1D1				
466	0x 1D2	float	kWatt		10
467	0x 1D3				
468	0x 1D4	float	kWatt		11
469	0x 1D5				
470	0x 1D6	float	kWatt		12
471	0x 1D7				
472	0x 1D8	float	kWatt		13
473	0x 1D9				
474	0x 1DA	float	kWatt		14
475	0x 1DB				
476	0x 1DC	float	kWatt		15
477	0x 1DD				
478	0x 1DE	float	kWatt		16
479	0x 1DF				
480	0x 1E0	float	kWatt		17
481	0x 1E1				
482	0x 1E2	float	kWatt		18
483	0x 1E3				
484	0x 1E4	float	kWatt		19
485	0x 1E5				
486	0x 1E6	float	kWatt		20
487	0x 1E7				
488	0x 1E8	float	kWatt		21
489	0x 1E9				
490	0x 1EA	float	kWatt		22
491	0x 1EB				
492	0x 1EC	float	kWatt		23
493	0x 1ED				
494	0x 1EE	float	kWatt		24
495	0x 1EF				
496	0x 1F0	float	kWatt		25
497	0x 1F1				
498	0x 1F2	float	kWatt		26
499	0x 1F3				
500	0x 1F4	float	kWatt		27
501	0x 1F5				
502	0x 1F6	float	kWatt		28
503	0x 1F7				
504	0x 1F8	float	kWatt		29
505	0x 1F9				
506	0x 1FA	float	kWatt		30
507	0x 1FB				
508	0x 1FC	float	kWatt		31
509	0x 1FD				
510	0x 1FE	float	kWatt		32
511	0x 1FF				
512	0x 200	float	kWH	energy of the last period	1
513	0x 201				
514	0x 202	float	kWH		2
515	0x 203				
516	0x 204	float	kWH		3
517	0x 205				
518	0x 206	float	kWH		4
519	0x 207				
520	0x 208	float	kWH		5
521	0x 209				

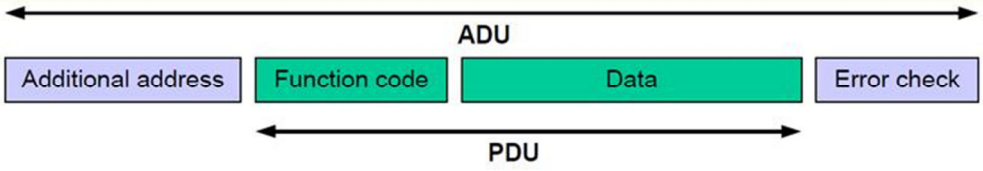
522	0x 20A	float	kWH		6
523	0x 20B				
524	0x 20C	float	kWH		7
525	0x 20D				
526	0x 20E	float	kWH		8
527	0x 20F				
528	0x 210	float	kWH		9
529	0x 211				
530	0x 212	float	kWH		10
531	0x 213				
532	0x 214	float	kWH		11
533	0x 215				
534	0x 216	float	kWH		12
535	0x 217				
536	0x 218	float	kWH		13
537	0x 219				
538	0x 21A	float	kWH		14
539	0x 21B				
540	0x 21C	float	kWH		15
541	0x 21D				
542	0x 21E	float	kWH		16
543	0x 21F				
544	0x 220	float	kWH		17
545	0x 221				
546	0x 222	float	kWH		18
547	0x 223				
548	0x 224	float	kWH		19
549	0x 225				
550	0x 226	float	kWH		20
551	0x 227				
552	0x 228	float	kWH		21
553	0x 229				
554	0x 22A	float	kWH		22
555	0x 22B				
556	0x 22C	float	kWH		23
557	0x 22D				
558	0x 22E	float	kWH		24
559	0x 22F				
560	0x 230	float	kWH		25
561	0x 231				
562	0x 232	float	kWH		26
563	0x 233				
564	0x 234	float	kWH		27
565	0x 235				
566	0x 236	float	kWH		28
567	0x 237				
568	0x 238	float	kWH		29
569	0x 239				
570	0x 23A	float	kWH		30
571	0x 23B				
572	0x 23C	float	kWH		31
573	0x 23D				
574	0x 23E	float	kWH		32
575	0x 23F				

Coils – digital input (modbus function code 1)					
address		type	units	description	
dec	hex				
0	0x 00	bit	-	digital input, CON2	
1	0x 01	bit	-	digital input, CON3	
2	0x 02	bit	-	digital input, CON4	

Holding registers – commands (modbus function code 10)				
address		type	description	
dec	hex			
0	0x 00	Hi byte	Comands: “hold”(0x01) or “mark”(0x02) or “change address”(0x0A)	
		Lo byte	if comand is “change address”, then set new target address	
1	0x 01	Hi byte	if comand is “change address”, then set new target address	
		Lo byte	if comand is “change address”, then set new target address	

MODBUS Functions

Modbus package structure:



For protocol description see "MODBUS APPLICATION PROTOCOL SPECIFICATION v1.1b". Implemented Modbus functions are as in the following table.

MODBUS FUNCTION	DESCRIPTION
1(0x01)	Read Coils
4 (0x04)	Read Input Registers
8 (0x08)	Diagnostics
16 (0x10)	Write Multiple Registers
17 (0x11)	Report Slave ID (Serial Line only)
20 (0x14)	Read File Record
21 (0x15)	Write File Record
43 (0x2B) (0x0E)	Read Device Identification

CAUTION

Do not use functions 20 and 21, can cause damage to card.

Functions 20 and 21 are used for device calibration.

MODBUS default card address

Modbus address can get a value of 1 to 247. Cards are taking those values sequentially depending their serial number and it is unlikely to have a conflict on a PV park. In such event, or in case of a replacement without changing any setting, address can be changed through Modbus using command “change address” (see above).

Address can be deducted from serial number written in hexadecimal form on board, considering the last two hex digits.

Note that Serial Number is typed on board (SN: ####) and can be read through modbus function 17 “Report Slave ID”.

Technical Assistance

If you need technical assistance or should it be necessary to return your product for repair or calibration use the contact details below:

SNV Engineering Ltd

Papadiamantopoulou 24 B

11528 Athens, Greece

web site: www.snveng.gr

email: snv@snveng.gr

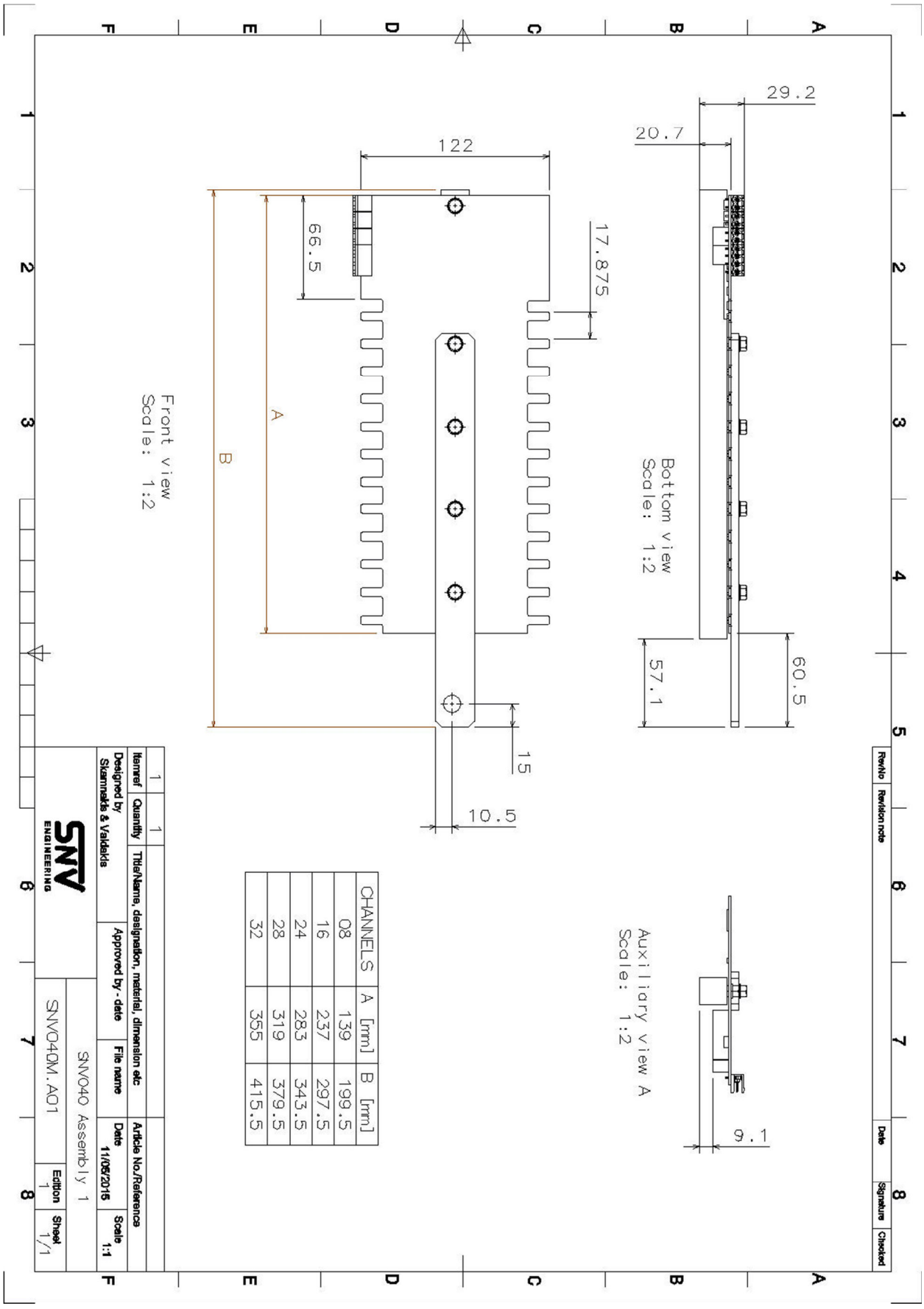
tel: +30 210 7779260

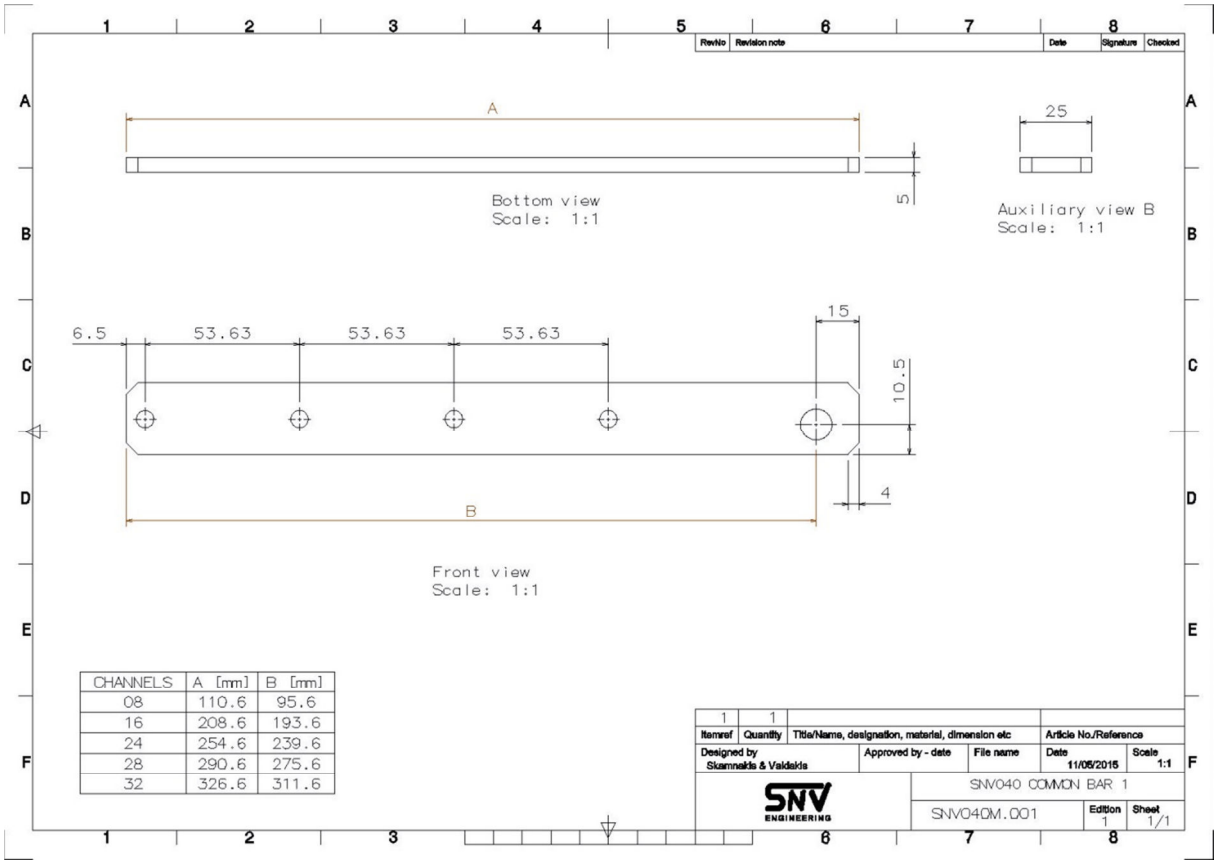
fax: +30 210 7703223

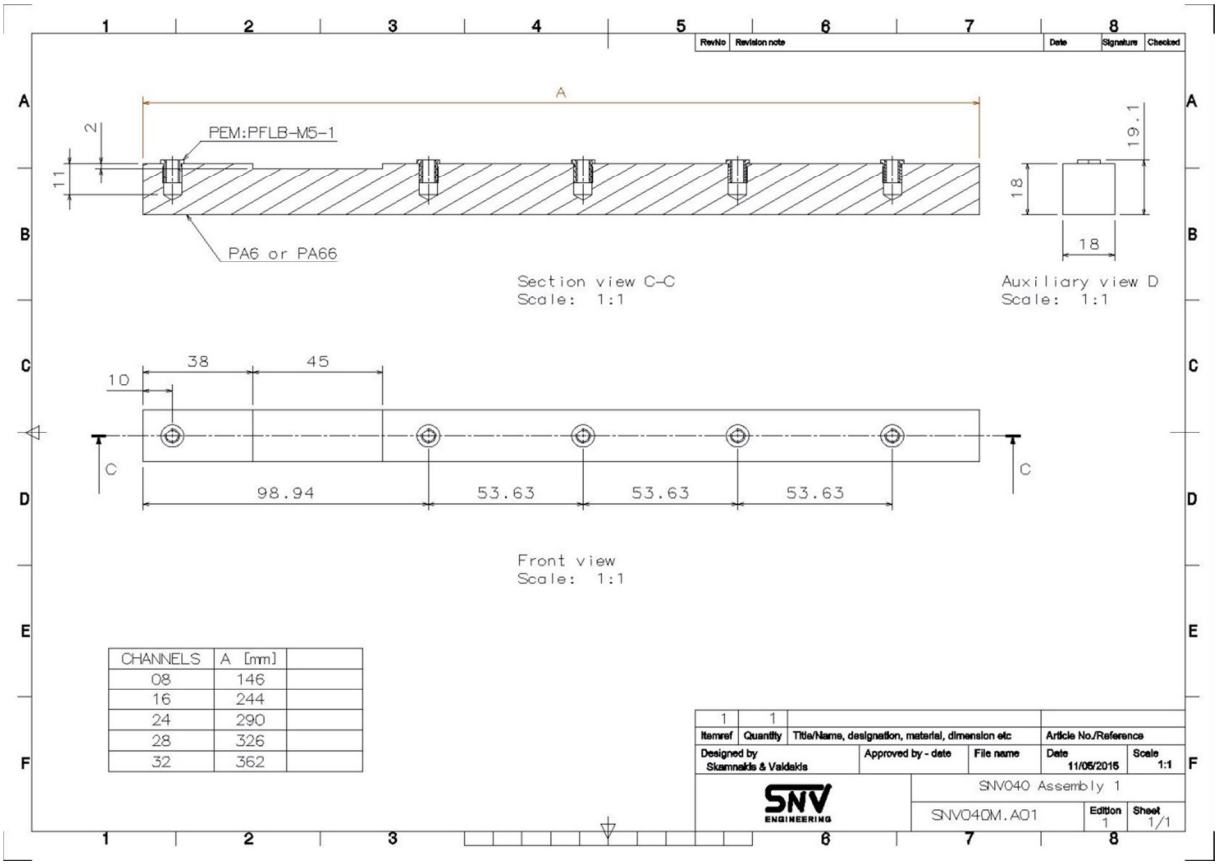
Annex A – Drawings

List of drawings:

No	Reference No	Description
1	SNV047M.A01	SNV047EC Card Assembly Dimensions
2	SNV047M.001	Copper collector bar (+)
3	SNV047M.004	Mounting bar 1
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		

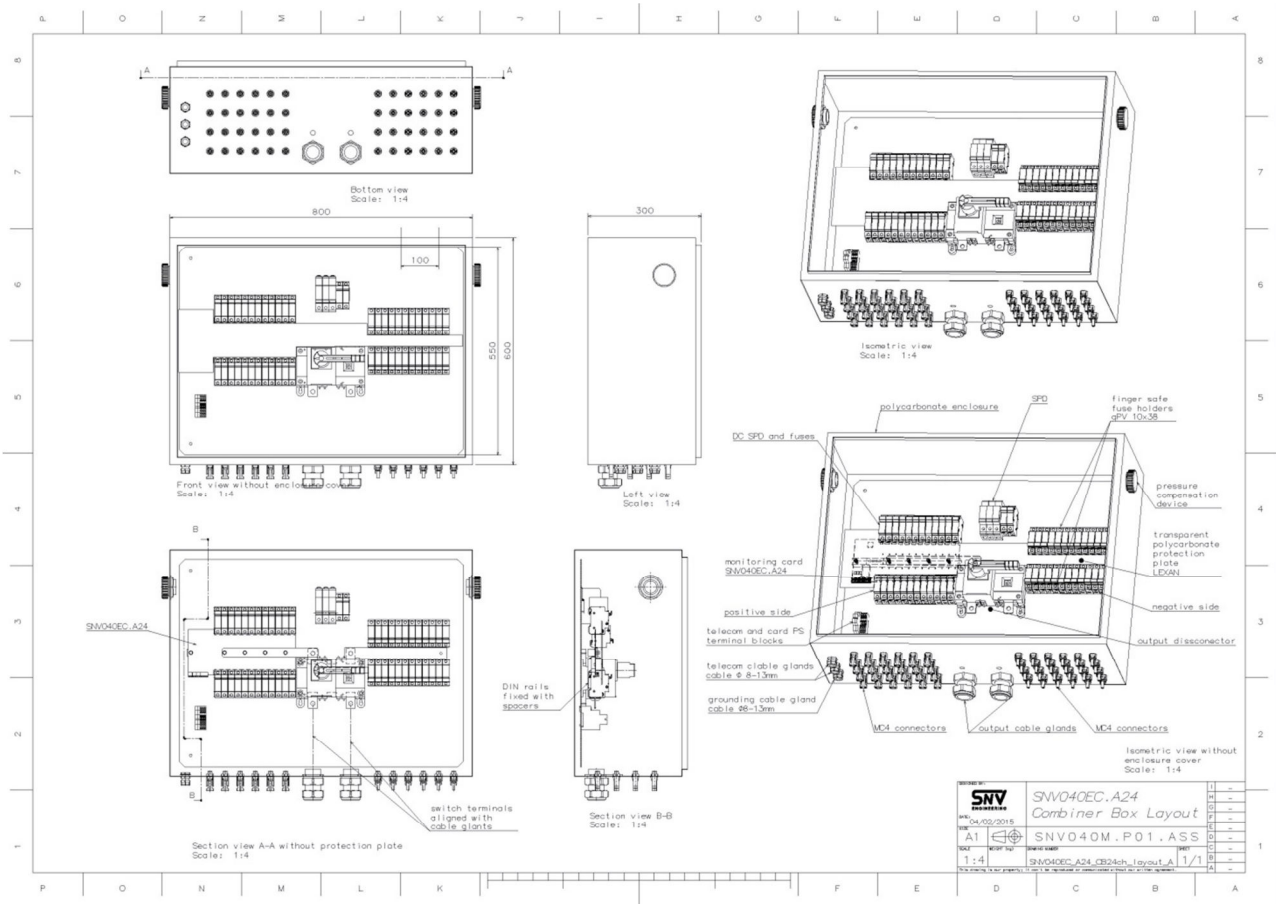






Annex B – Recommended board integration

3D views



Photos