

• 15P0101B1 •
SINUS PENTA

**ASSEMBLY
INSTRUCTIONS FOR
MODULAR INVERTERS**

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R.01

English

- This manual is integrant and essential to the product. Carefully read the instructions contained herein as they provide important hints for use and maintenance safety.
- This device is to be used only for the purposes it has been designed to. Other uses should be considered improper and dangerous. The manufacturer is not responsible for possible damages caused by improper, erroneous and irrational uses.
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- Any changes to the structure or operating cycle of the device must be performed or authorized by the Engineering Department of Enertronica Santerno S.p.A..
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1. OVERVIEW

High power inverters of the SINUS PENTA series manufactured from Enertronica Santerno S.p.A. are obtained by matching the following individual modules:

- The Control Unit, containing the control board and the interface board (ES842);
- The Power Supply Module, composed of a three-phase power rectifier and its control circuit and supply circuits;
- The Inverter Module, composed of one inverter phase and its control circuits;
- The braking unit (optional)

Four types of Inverter Modules are available:

- Basic Inverter Module;
- Inverter Module with on-board control unit;
- Inverter Module with on-board aux supply unit (to be used for those models which are not equipped with the power supply module – size S74);
- Inverter Module with on-board splitter unit (to be used for the models allowing connection in parallel of the inverter modules).

Two types of braking unit (optional) are available:

- Basic version;
- Version provided with on-board splitter unit (to be used for the models allowing using two parallel-connected braking units). See section 2.5 for the internal wiring.

The inverter properly dimensioned to meet the requirements of your industrial application is obtained by composing the components above.

This manual covers the assembly instructions of the modular SINUS PENTA inverters S74-S80 and is addressed to the Customers who have not purchased the Sinus Penta CABINET version.



NOTE

As per the greatest sizes (S84-S90), the existing configurations only are covered in this manual; for details on the inverter assembly, please contact Enertronica Santerno S.p.A..

The inverter assembly comprises the wiring between the inverter module and the power supply units, if fitted.

This Manual also covers the recommended input/output reactors.



NOTE

This Manual is a complement to the Sinus Penta's Installation Instructions.



CAUTION

Properly configure ES842 control board inside the control unit case. When ordering the inverter, always state the inverter configuration you intend to obtain.

Size	Model	Voltage class	Equipment configuration				
			Power supply modules	Inverter modules with control unit	Basic inverter modules	Inverter modules with splitter unit	Braking units [*]
S75	0964	4T	2	1	2	3	1
	1130	4T	2	1	2	3	1
	1296	4T	2	1	2	3	2
	0964	5T-6T	2	1	2	3	1
	1130	5T-6T	2	1	2	3	2
S80	1296	5T-6T	3	1	2	3	2
S90	1800	4T	3	1	5	3	2
	2076	4T	3	1	5	3	2
	1800	5T-6T	3	1	5	3	2
	2076	5T-6T	3	1	5	3	2

Size	Model	Voltage class	Equipment configuration				
			Power supply modules	Inverter modules with control unit	Basic Inverter modules	Inverter modules with splitter unit	Braking units [*]
S74	0964	4C	–	1	2	3	1
	1130	4C	–	1	2	3	1
	1296	4C	–	1	2	3	2
	0964	5C-6C	–	1	2	3	1
	1130	5C-6C	–	1	2	3	2
	1296	5C-6C	–	1	2	3	2
S84	1800	4C	–	1	5	3	2
	2076	4C	–	1	5	3	2
	1800	5C-6C	–	1	5	3	2
	2076	5C-6C	–	1	5	3	2



NOTE The braking units are optional.



NOTE [*] The internal wiring for the dual configuration of the braking units is given in section 2.5.

2. WIRING DIAGRAM FOR MODULAR INVERTERS S74-S80



NOTE

In the modular inverters wiring diagrams, the power supply units are defined as illustrated in the diagram below:

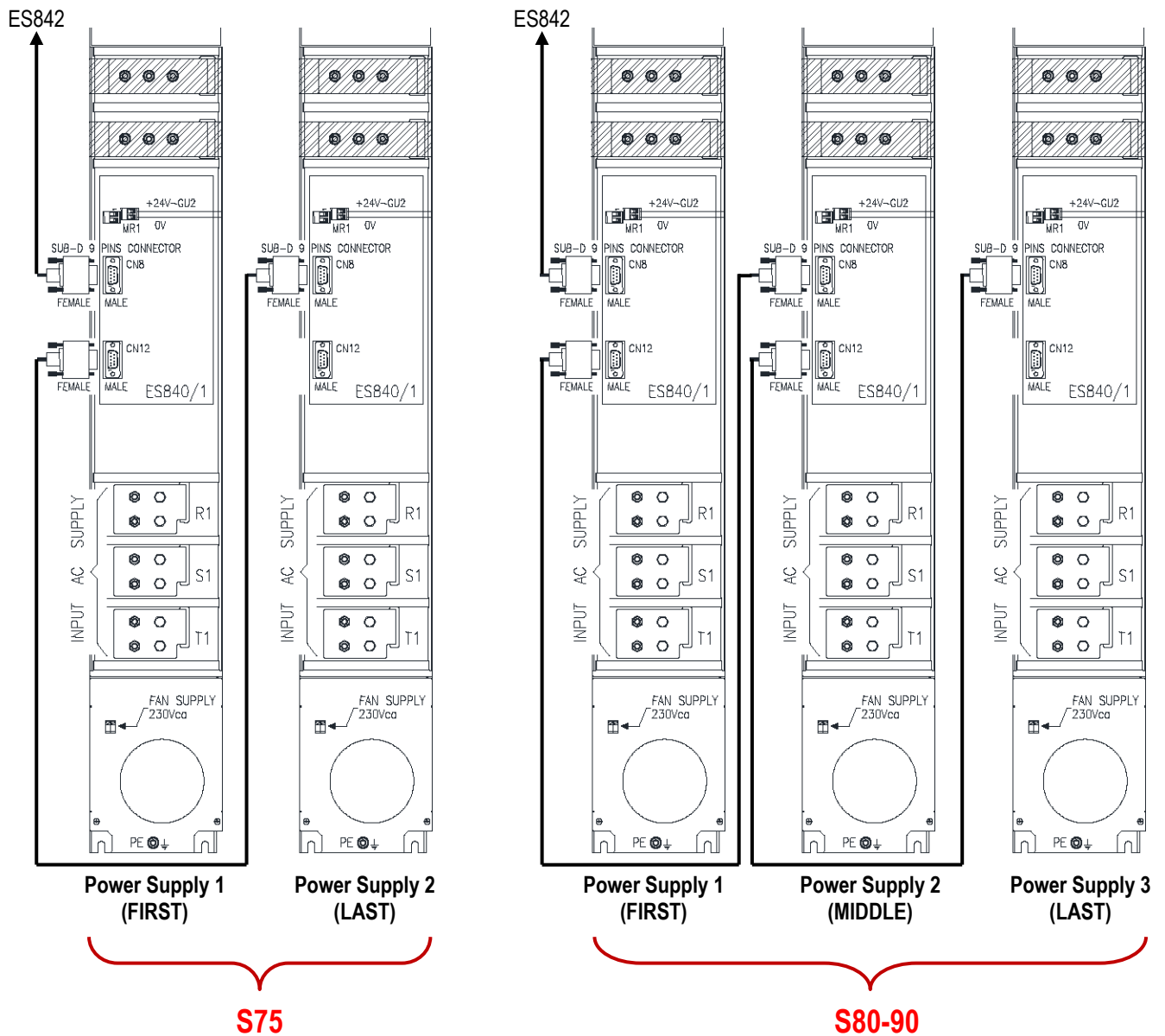


Figure 1: Cascade connection of the power supply modules

Based on the inverter size, the Power Supply Unit 2 may be either the last unit in the chain (LAST in Size S75) or the middle unit in the chain (MIDDLE in Sizes S80-S90).

Therefore, different settings are required for ES840/1 board, as described in section 2.6.1 later on in this manual.

2.1. External Wiring for Modular Inverters S75 and S80

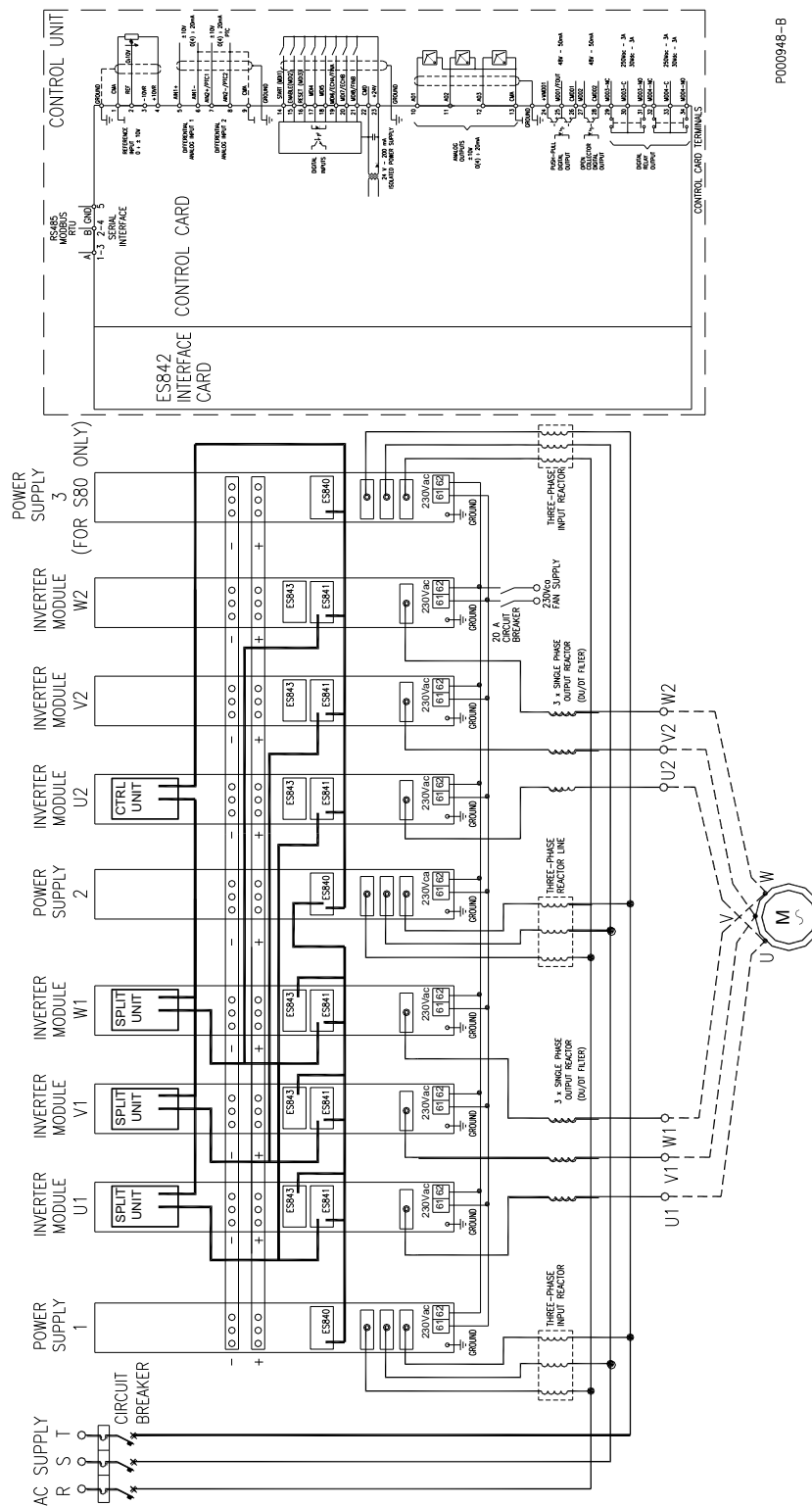
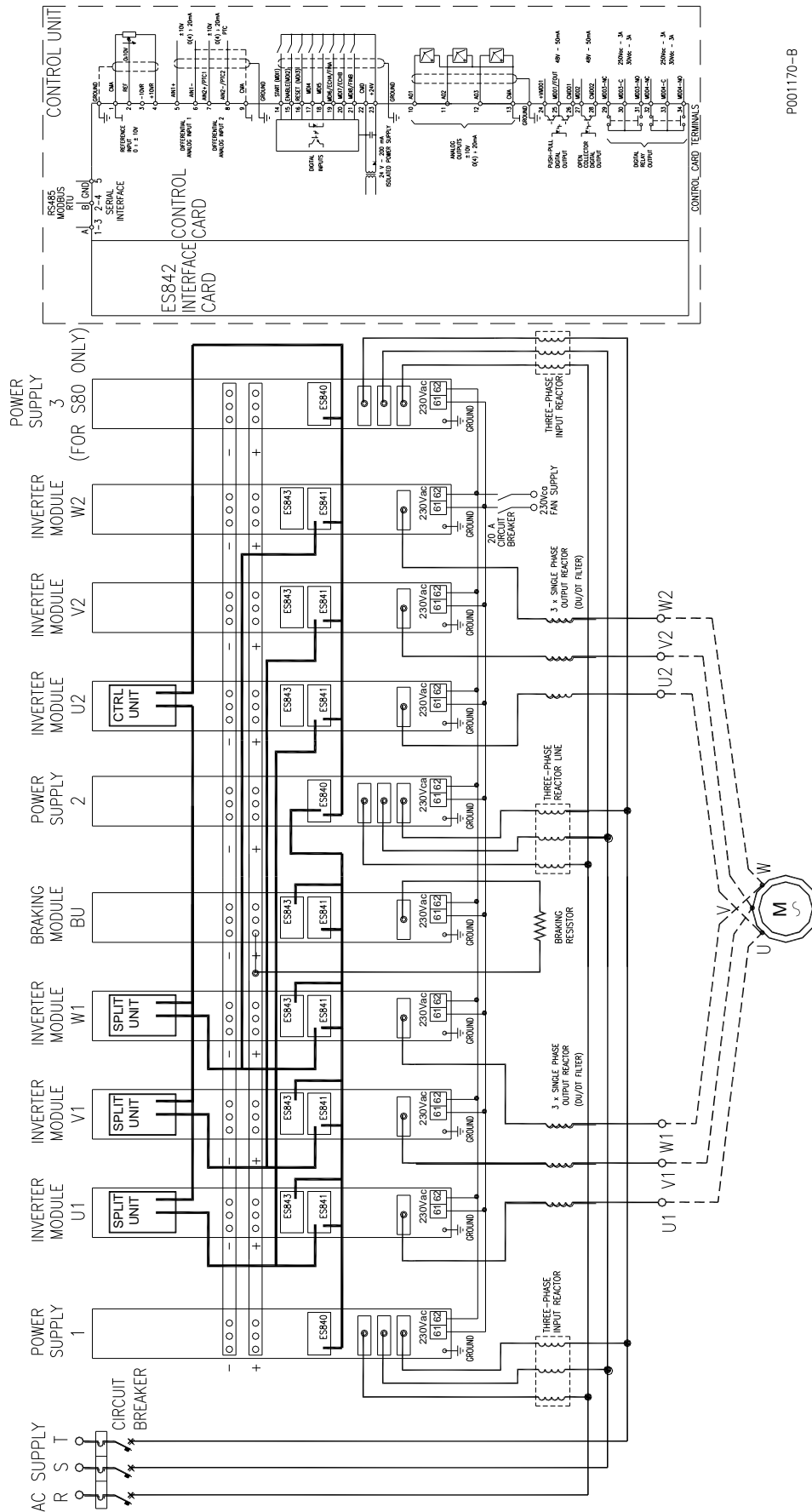
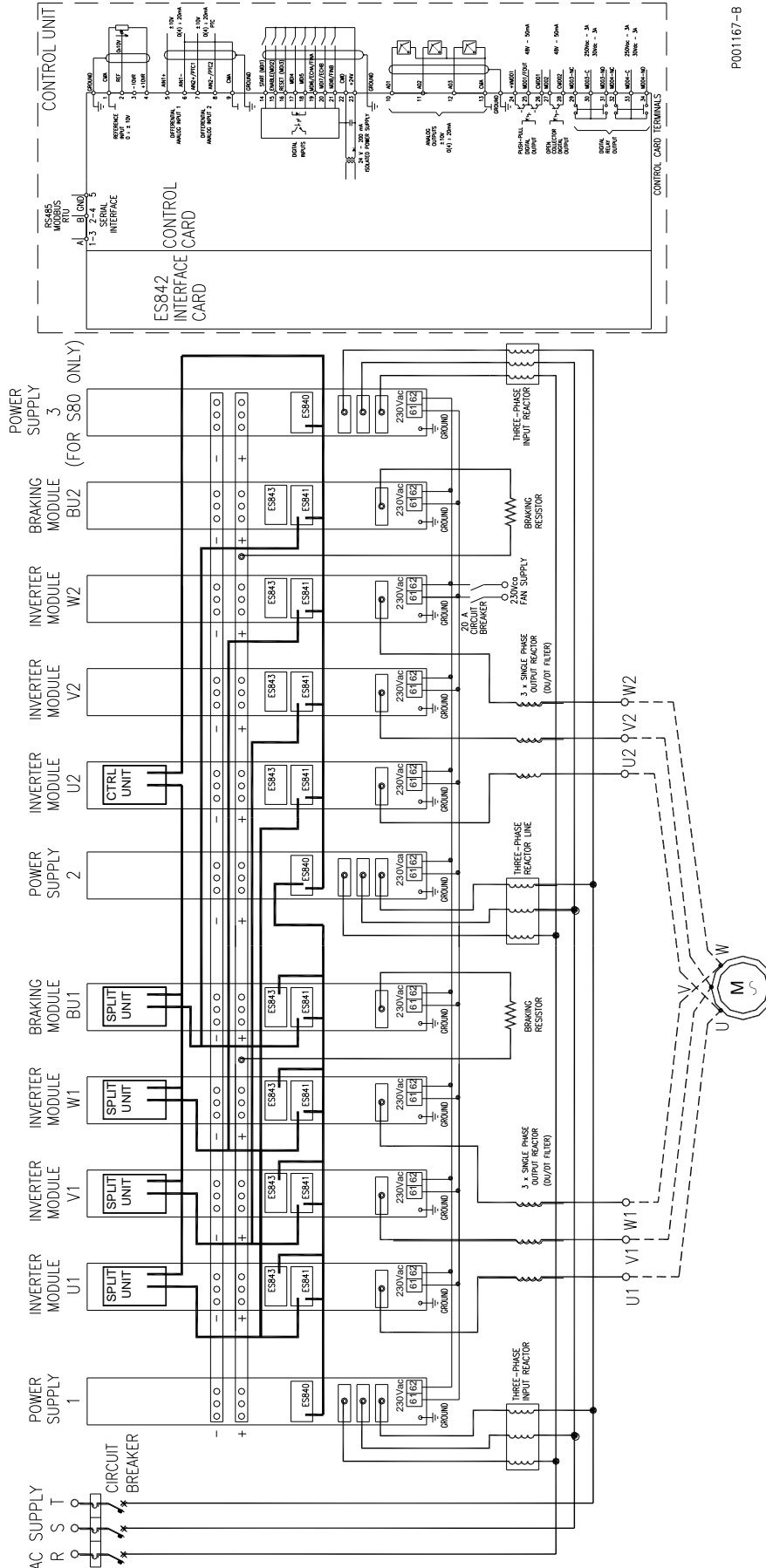


Figure 2: External wiring for inverters S75 and S80



P001170-B

Figure 3: External wiring for inverters S75 and S80 + n.1 braking unit (optional)



P001167-B

Figure 4: External wiring for inverters S75 and S80 + n.2 braking units (optional)



NOTE

Power supply unit 3 is available for size S80 only.



NOTE

The power supply units (1, 2 and 3 if required) may also be mounted as the two (three) central power supply units, between inverters modules U1/V1/W1 and U2/V2/W2.



NOTE

The braking units are optional.



NOTE

The internal wiring for the dual configuration of the braking units is given in section 2.5.



CAUTION

In case of fuse line protection, always install the fuse failure detection device, that disables the inverter, to avoid single-phase operation of the equipment.



NOTE

Details on the reactors are given in Three-phase Input Reactors for Modular Inverters S75 and S80 and Single-phase Output Reactors for Modular Inverters S75 and S80.



CAUTION

As shown in the figure above, use wires with the same length for each of the two parallel-connected inverters to obtain separate links reaching the connected motor. Three-phase wires are recommended.

2.2. External Wiring for Modular Inverters S74

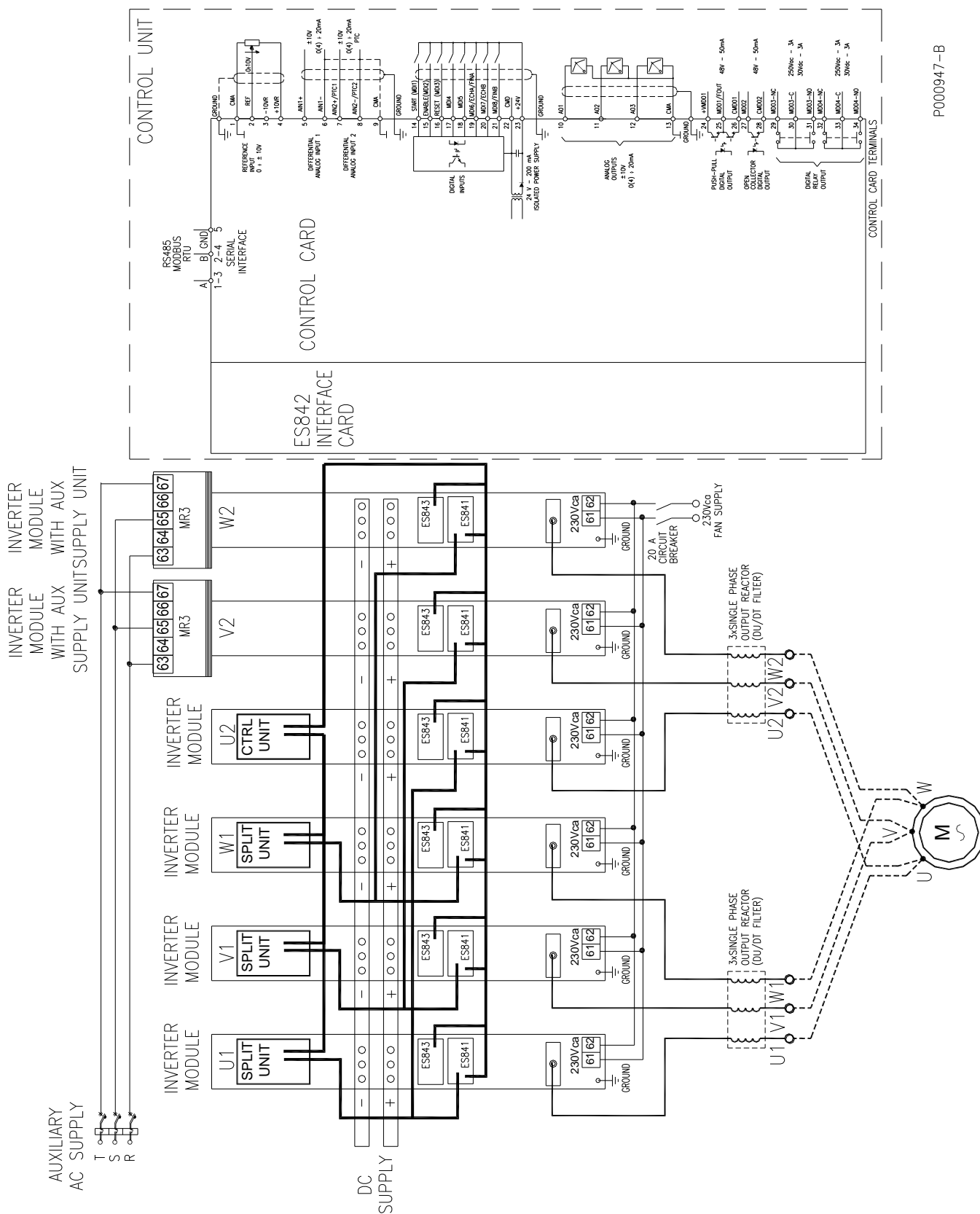
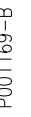
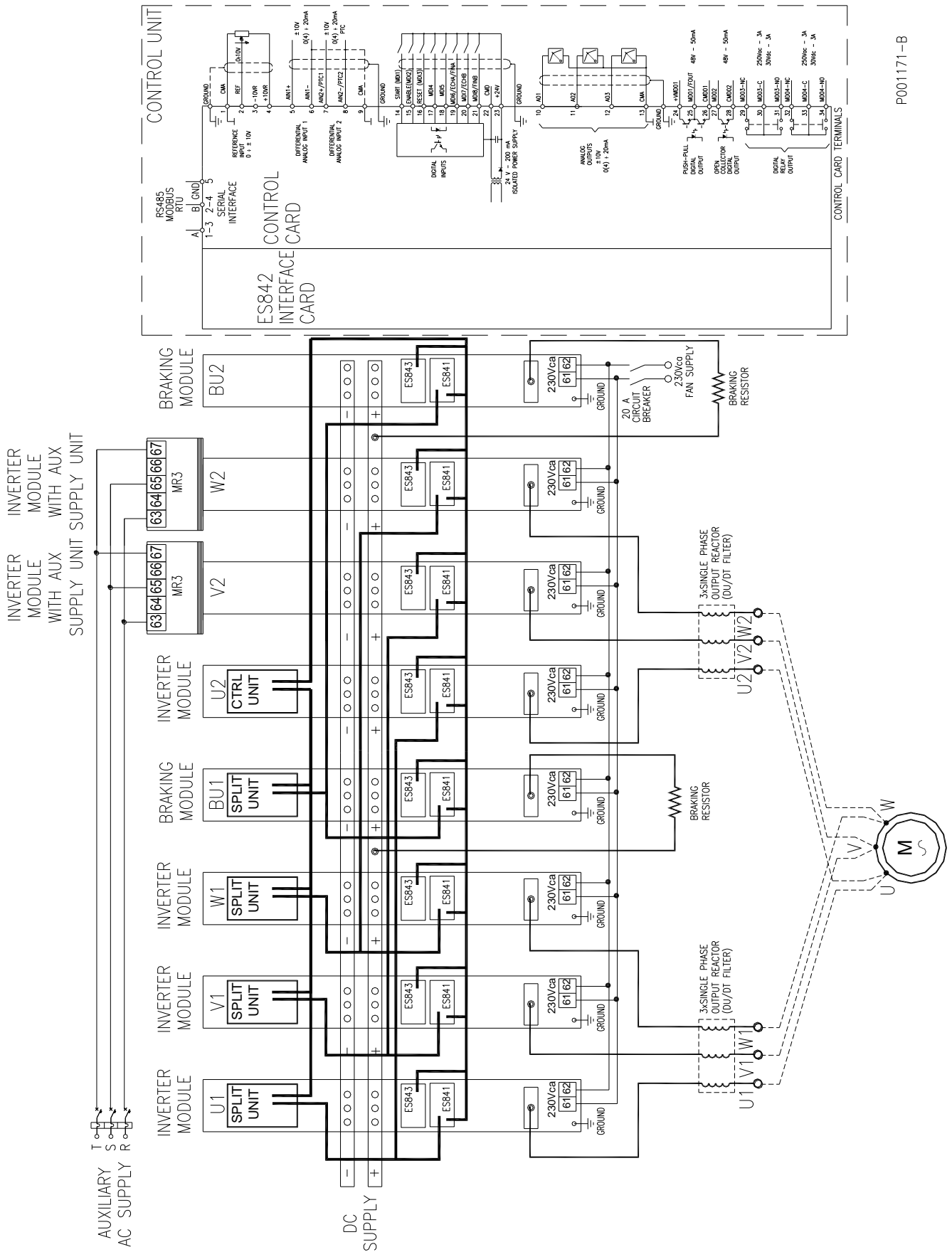


Figure 5: External wiring for inverters S74



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NOTE The braking units are optional.



NOTE The internal wiring for the dual configuration of the braking units is given in section 2.5.



CAUTION The capacitors inside the DC power supply unit must always be precharged. Failure to do so will damage the inverter as well as its power supply unit.



NOTE Details on the reactors are given in Single-phase Output Reactors for Modular Inverters S75 and S80.



CAUTION As shown in the figure above, use wires with the same length for each of the two parallel-connected inverters to obtain separate links reaching the connected motor. Three-phase wires are recommended.



2.3. Internal Wiring for Modular Inverters S75 - S80

Modular inverters S75 and S80 use both parallel-connected inverter modules and power supply modules. To obtain parallel-connection, inverter modules equipped with splitter boards are required.

The following links are required:

N. 2 power connections with 60*10mm copper bar between the power supply units and the inverter modules in order to deliver DC voltage.

N. 12 links with 9-pole shielded cable (S80) or N. 11 links with 9-pole shielded cable (S75) for the analog measures.

Type of cable: shielded cable

N. of conductors: 9

Diameter of each conductor: AWG20÷24 (0.6÷0.22mm²)

Connectors: 9-pole SUB-D female connectors

Connections within the cable:

Connector	SUB-D Female connector	SUB-D Female connector
pin	1 →	1
pin	2 →	2
pin	3 →	3
pin	4 →	4
pin	5 →	5
pin	6 →	6
pin	7 →	7
pin	8 →	8
pin	9 →	9

Connections required:

- from control unit to power supply unit 1 (control signals for power supply unit 1)
- from power supply unit 1 to power supply unit 2 (control signals for power supply unit 2)
- S80 only: from power supply unit 2 to power supply unit 3 (control signals for power supply unit 3)
- from control unit to splitter board in inverter module U1 (phase U control signals)
- from control unit to splitter board in inverter module V1 (phase V control signals)
- from control unit to splitter board in inverter module W1 (phase W control signals)
- from splitter board in inverter module U1 to inverter leg U1 (phase U1 control signals)
- from splitter board in inverter module V1 to inverter leg V1 (phase V1 control signals)
- from splitter board in inverter module W1 to inverter leg W1 (phase W1 control signals)
- from splitter board in inverter module U1 to inverter leg U2 (phase U2 control signals)
- from splitter board in inverter module V1 to inverter leg V2 (phase V2 control signals)
- from splitter board in inverter module W1 to inverter leg W2 (phase W2 control signals)

N. 10 connections with unipolar, twisted pair cables, type AWG17-18 (1mm²), for AC low voltage supply to the electronic boards (N. 11 connections if an optional braking unit is connected).

Connections required:

- from power supply unit 1 to the driver boards for each inverter leg 1 (from the power supply unit to the driver board in inverter leg U1, from this driver board to the next in inverter leg V1, from this driver board to the next in inverter leg W1) (+24V supply to IGBT driver boards)
- from driver board in inverter leg W1 to optional braking unit BU[*] (+24V supply to braking unit)
- from power supply unit 2 to the driver boards for each inverter leg 2 (from the power supply unit to driver board in inverter leg U2, from this driver board to the next in inverter leg V2, from this driver board to the next in inverter leg W2) (+24V supply to IGBT driver boards)
- from power supply unit 1 to the splitter boards (+24V supply to splitter boards) (from the power supply unit to the splitter board in inverter leg U1, from this splitter board to the next in inverter leg V1, from this splitter board to the next in inverter leg W1)
- from splitter board in inverter module W1 to control unit (+24V supply to control unit)

N. 13 optical fibre connections, 1mm, standard single plastic material (typical damping: 0.22dB/m), with connectors type Agilent HFBR-4503/4513 (N. 15 connections if an optional braking unit is installed).

HFBR-4503/4513 — Simplex Latching

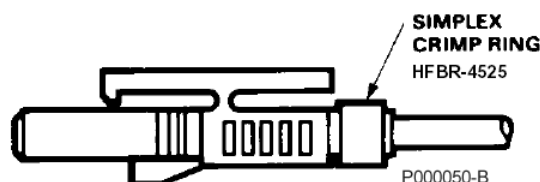


Figure 8: Single optical fibre connector

Connections required:

- from control unit to splitter board in inverter leg U1 (fault U signal)
- from control unit to splitter board in inverter leg V1 (fault V signal)
- from control unit to splitter board in inverter leg W1 (fault W signal)
- from control unit to optional braking unit BU[*] (Braking unit fault signal)
- from control unit to optional braking unit BU[*] (Braking unit gate signal)
- from splitter board in inverter module U1 to inverter leg U1 (fault U1 signal)
- from splitter board in inverter module V1 to inverter leg V1 (fault V1 signal)
- from splitter board in inverter module W1 to inverter leg W1 (fault W1 signal)
- from splitter board in inverter module U1 to inverter leg U2 (fault U2 signal)
- from splitter board in inverter module V1 to inverter leg V2 (fault V2 signal)
- from splitter board in inverter module W1 to inverter leg W2 (fault W2 signal)
- from control unit to bus voltage reading board mounted on inverter leg V1 (VB signal)
- from control unit to bus voltage reading board mounted on inverter leg U1 (sense U signal)
- from control unit to bus voltage reading board mounted on inverter leg V1 (sense V signal)
- from control unit to bus voltage reading board mounted on inverter leg W1 (sense W signal)



NOTE The braking units are optional.



NOTE [*] The internal wiring for the dual configuration of the braking units is given in section 2.5.

N. 9 optical fibre connections, 1mm, standard double plastic material (typical damping 0.22dB/m), with connectors type Agilent HFBR-4516.

HFBR-4516 — Duplex Latching

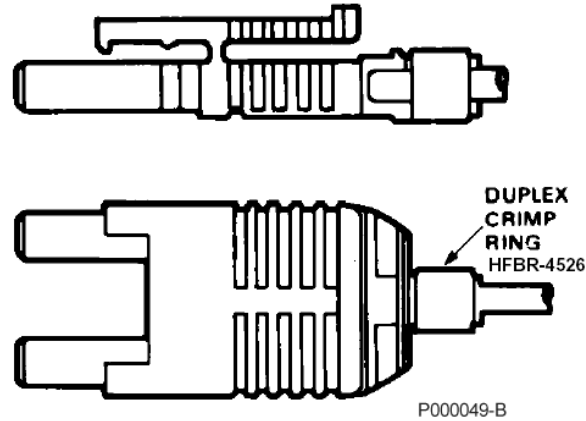


Figure 9: Double optical fibre connector

Connections required:

- from control unit to splitter unit in inverter leg U1 (gate U signal)
- from control unit to splitter unit in inverter leg V1 (gate V signal)
- from control unit to splitter unit in inverter leg W1 (gate W signal)
- from splitter board in inverter module U1 to inverter leg U1 (phase U1 gate signal)
- from splitter board in inverter module V1 to inverter leg V1 (phase V1 gate signal)
- from splitter board in inverter module W1 to inverter leg W1 (phase W1 gate signal)
- from splitter board in inverter module U1 to inverter leg U2 (phase U2 gate signal)
- from splitter board in inverter module V1 to inverter leg V2 (phase V2 gate signal)
- from splitter board in inverter module W1 to inverter leg W2 (phase W2 gate signal)

2.3.1. INTERNAL WIRING S75-S80

2.3.1.1. COPPER CABLE CONNECTIONS

Signal	Type of connection	Cable marking	From	Board	Connector	To	Board	Connector
Control signals, power supply unit 1	9-pole shielded cable	C-PS1	Control unit	ES842	CN4	Power supply unit 1	ES840/1	CN8
Control signals, power supply unit 2	9-pole shielded cable	PS1-PS2	Power supply unit 1	ES840/1	CN12	Power supply unit 2	ES840/1	CN8
Control signals, power supply unit 3 [**]	9-pole shielded cable	PS2-PS3	Power supply unit 2	ES840/1	CN12	Power supply unit 3	ES840/1	CN8
Control signals, phase U	9-pole shielded cable	C-U	Control unit	ES842	CN14	Phase U1	ES887	CN15
Control signals, phase V	9-pole shielded cable	C-V	Control unit	ES842	CN11	Phase V1	ES887	CN15
Control signals, phase W	9-pole shielded cable	C-W	Control unit	ES842	CN8	Phase W1	ES887	CN15
Control signals, phase U1	9-pole shielded cable	C-U1	Phase U1	ES887	CN16	Phase U1	ES841	CN6
Control signals, phase V1	9-pole shielded cable	C-V1	Phase V1	ES887	CN16	Phase V1	ES841	CN6
Control signals, phase W1	9-pole shielded cable	C-W1	Phase W1	ES887	CN16	Phase W1	ES841	CN6
Control signals, phase U2	9-pole shielded cable	C-U2	Phase U1	ES887	CN17	Phase U2	ES841	CN6
Control signals, phase V2	9-pole shielded cable	C-V2	Phase V1	ES887	CN17	Phase V2	ES841	CN6
Control signals, phase W2	9-pole shielded cable	C-W2	Phase W1	ES887	CN17	Phase W2	ES841	CN6



NOTE **[**]** Fitted on Size S80 only.



Signal	Type of connection	Cable marking	From	Board	Connector	To	Board	Connector
+24VD Power supply, driver boards ES841, phase U1	Unipolar cable, 1mm ²	24V-GU1	Power supply unit 1	ES840/1	MR1-3	Phase U1	ES841	MR1-1
0VD Power supply, driver boards ES841, phase U1	Unipolar cable, 1mm ²		Power supply unit 1	ES840/1	MR1-4	Phase U1	ES841	MR1-2
+24VD Power supply, driver boards ES841, phase V1	Unipolar cable, 1mm ²	24V-GV1	Phase U1	ES841	MR1-3	Phase V1	ES841	MR1-1
0VD Power supply, driver boards ES841, phase V1	Unipolar cable, 1mm ²		Phase U1	ES841	MR1-4	Phase V1	ES841	MR1-2
+24VD Power supply, driver boards ES841, phase W1	Unipolar cable, 1mm ²	24V-GW1	Phase V1	ES841	MR1-3	Phase W1	ES841	MR1-1
0VD Power supply, driver boards ES841, phase W1	Unipolar cable, 1mm ²		Phase V1	ES841	MR1-4	Phase W1	ES841	MR1-2
+24V Power supply, BU ES841 driver boards [*]	Unipolar cable, 1mm ²	24V-BU	Phase W1	ES841	MR1-3	BU	ES841	MR1-1
0V Power supply, BU ES841 driver boards [*]	Unipolar cable, 1mm ²		Phase W1	ES841	MR1-4	BU	ES841	MR1-2
+24VD Power supply, driver boards ES841, phase U2	Unipolar cable, 1mm ²	24V-GU2	Power supply unit 2	ES840/1	MR1-3	Phase U2	ES841	MR1-1
0VD Power supply, driver boards ES841, phase U2	Unipolar cable, 1mm ²		Power supply unit 2	ES840/1	MR1-4	Phase U2	ES841	MR1-2
+24VD Power supply, driver boards ES841, phase V2	Unipolar cable, 1mm ²	24V-GV2	Phase U2	ES841	MR1-3	Phase V2	ES841	MR1-1
0VD Power supply, driver boards ES841, phase V2	Unipolar cable, 1mm ²		Phase U2	ES841	MR1-4	Phase V2	ES841	MR1-2
+24VD Power supply, driver boards ES841, phase W2	Unipolar cable, 1mm ²	24V-GW2	Phase V2	ES841	MR1-3	Phase W2	ES841	MR1-1
0VD Power supply, driver boards ES841, phase W2	Unipolar cable, 1mm ²		Phase V2	ES841	MR1-4	Phase W2	ES841	MR1-2
+24VD Power supply, splitter board, phase U	Unipolar cable, 1mm ²	24V-SU	Power supply unit 1	ES840/1	MR1-1	Phase U1	ES887	MR1-1
0V Power supply, splitter board, phase U	Unipolar cable, 1mm ²		Power supply unit 1	ES840/1	MR1-2	Phase U1	ES887	MR1-2
+24V Power supply, splitter board, phase V	Unipolar cable, 1mm ²	24V-SV	Phase U1	ES887	MR1-3	Phase V1	ES887	MR1-1
0V Power supply, splitter board, phase V	Unipolar cable, 1mm ²		Phase U1	ES887	MR1-4	Phase V1	ES887	MR1-2
+24V Power supply, splitter board, phase W	Unipolar cable, 1mm ²	24V-SW	Phase V1	ES887	MR1-3	Phase W1	ES887	MR1-1
0V Power supply, splitter board, phase W	Unipolar cable, 1mm ²		Phase V1	ES887	MR1-4	Phase W1	ES887	MR1-2
Control unit +24V power supply	Unipolar cable, 1mm ²	24V-C	Phase W1	ES887	MR1-3	Control unit	ES842	MR1-1
Control unit 0V power supply	Unipolar cable, 1mm ²		Phase W1	ES887	MR1-4	Control unit	ES842	MR1-2



NOTE The braking units are optional.



NOTE [*] The internal wiring for the dual configuration of the braking units is given in section 2.5.

2.3.1.2. OPTICAL FIBRE CONNECTIONS

Signal	Type of connection	Cable marking	From	Board	Connector	To	Board	Connector
IGBT command, phase U	Double optical fibre	G-U	Control unit	ES842	OP19-OP20	Phase U1	ES887	CN9-CN10
IGBT command, phase V	Double optical fibre	G-V	Control unit	ES842	OP13-OP14	Phase V1	ES887	CN9-CN10
IGBT command, phase W	Double optical fibre	G-W	Control unit	ES842	OP8-OP9	Phase W1	ES887	CN9-CN10
IGBT command, phase U1	Double optical fibre	G-U1	Phase U1	ES887	CN1-CN4	Phase U1	ES841	OP4-OP5
IGBT command, phase V1	Double optical fibre	G-V1	Phase V1	ES887	CN1-CN4	Phase V1	ES841	OP4-OP5
IGBT command, phase W1	Double optical fibre	G-W1	Phase W1	ES887	CN1-CN4	Phase W1	ES841	OP4-OP5
IGBT command, phase U2	Double optical fibre	G-U2	Phase U1	ES887	CN2-CN5	Phase U2	ES841	OP4-OP5
IGBT command, phase V2	Double optical fibre	G-V2	Phase V1	ES887	CN2-CN5	Phase V2	ES841	OP4-OP5
IGBT command, phase W2	Double optical fibre	G-W2	Phase W1	ES887	CN2-CN5	Phase W2	ES841	OP4-OP5

Signal	Type of connection	Cable marking	From	Board	Connector	To	Board	Connector
IGBT command, phase U	Double optical fibre	G-U	Control unit	ES842	OP19-OP20	Phase U1	ES887	CN9-CN10
IGBT command, phase V	Double optical fibre	G-V	Control unit	ES842	OP13-OP14	Phase V1	ES887	CN9-CN10
IGBT command, phase W	Double optical fibre	G-W	Control unit	ES842	OP8-OP9	Phase W1	ES887	CN9-CN10
IGBT command, phase U1	Double optical fibre	G-U1	Phase U1	ES887	CN1-CN4	Phase U1	ES841	OP4-OP5
IGBT command, phase V1	Double optical fibre	G-V1	Phase V1	ES887	CN1-CN4	Phase V1	ES841	OP4-OP5
IGBT command, phase W1	Double optical fibre	G-W1	Phase W1	ES887	CN1-CN4	Phase W1	ES841	OP4-OP5
IGBT command, phase U2	Double optical fibre	G-U2	Phase U1	ES887	CN2-CN5	Phase U2	ES841	OP4-OP5
IGBT command, phase V2	Double optical fibre	G-V2	Phase V1	ES887	CN2-CN5	Phase V2	ES841	OP4-OP5
IGBT command, phase W2	Double optical fibre	G-W2	Phase W1	ES887	CN2-CN5	Phase W2	ES841	OP4-OP5
BU IGBT Fault[*]	Single optical fibre	FA-BU	Control unit	ES842	OP3	BU	ES841	OP8
Vbus Reading	Single optical fibre	VB	Control unit	ES842	OP2	Phase V1	ES843	OP2
IGBT status, phase U	Single optical fibre	ST-U	Control unit	ES842	OP16	Phase U1	ES843	OP1
IGBT status, phase V	Single optical fibre	ST-V	Control unit	ES842	OP11	Phase V1	ES843	OP1
IGBT status, phase W	Single optical fibre	ST-W	Control unit	ES842	OP6	Phase W1	ES843	OP1
BU IGBT Command[*]	Single optical fibre	BO-BU	Control unit	ES842	OP4	BU	ES841	OP5



CAUTION

NEVER apply voltage to the equipment when the optical fibre connectors are disconnected.



NOTE

The braking units are optional.



NOTE

[*] The internal wiring for the dual configuration of the braking units is given in section 2.5.

The diagram below illustrates the connections required for the components of the modular inverter model.

P001046-B

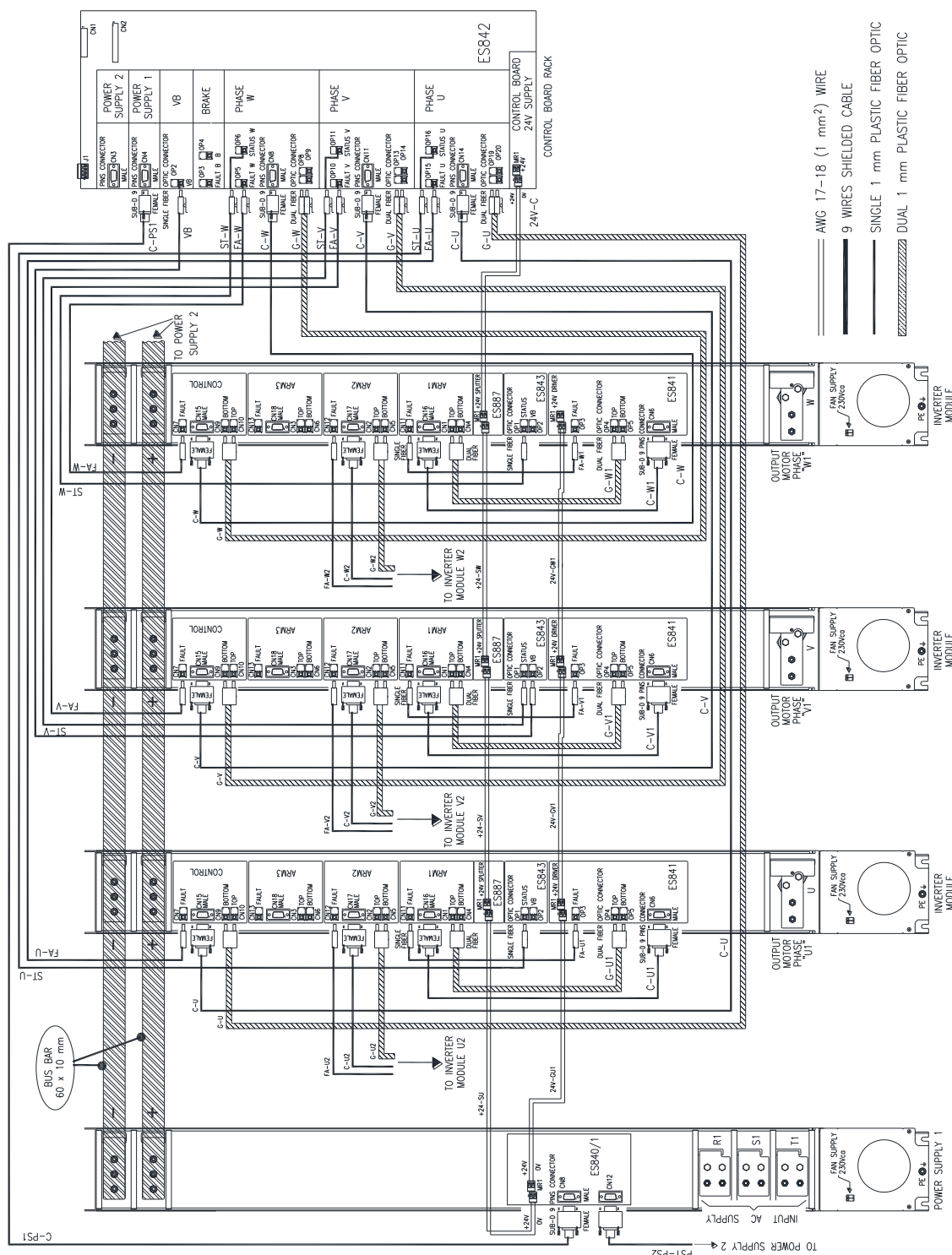


Figure 10: Internal wiring for inverters S75 and S80 (Power supply 1 and Inverter modules U1/V1/W1)

Figure 11: Internal wiring for inverters S75 and S80 (Power supply 1, Inverter modules U1/V1/W1 and Braking Unit)

P001047-B

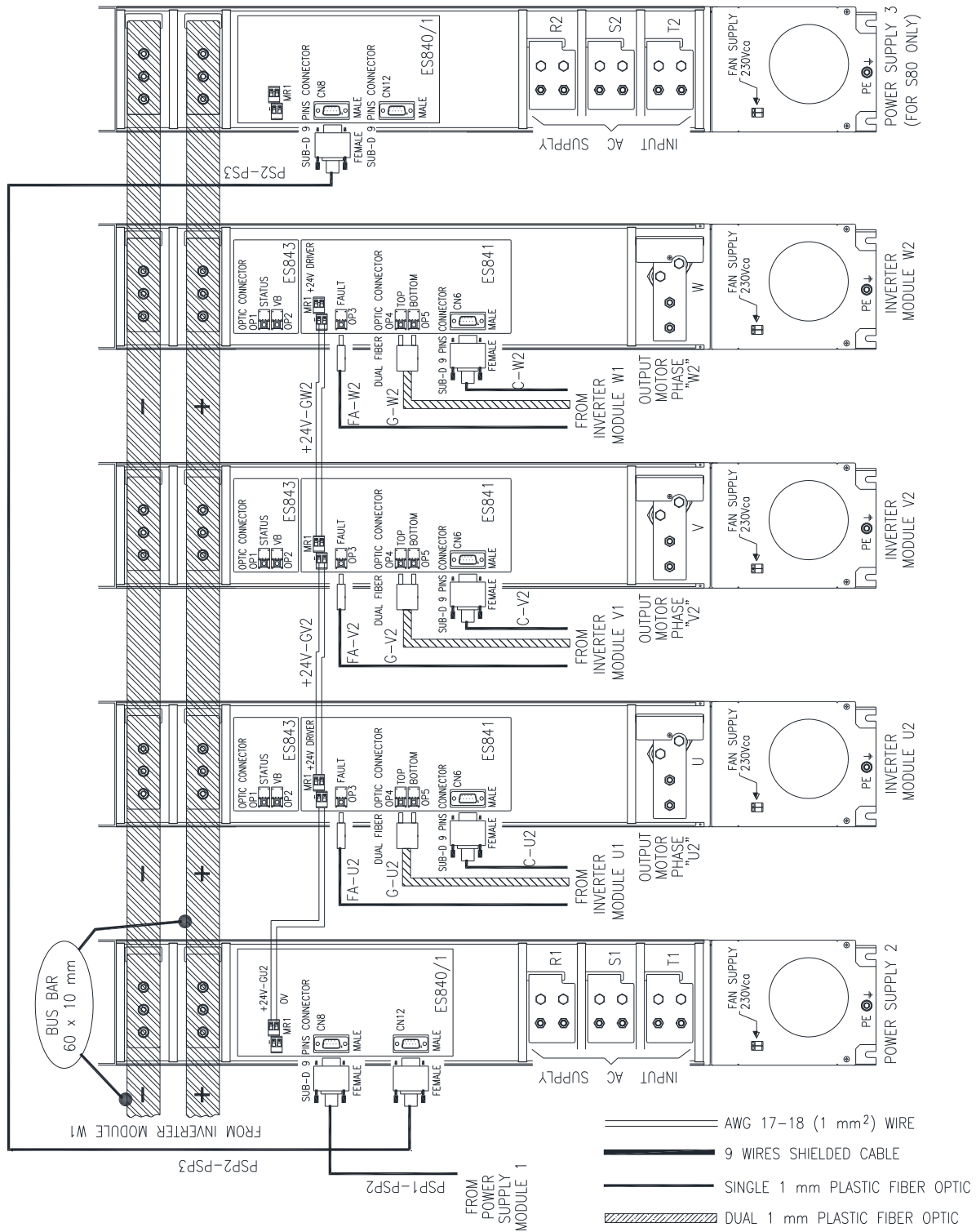


Figure 12: Internal wiring for inverters S75 and S80 (Power supply 2/3 and Inverter modules U2/V2/W2)

2.4. Internal Wiring for Modular Inverters S74

The following connections are needed:

N. 2 power connections with copper bar 60*10mm between the inverter modules for DC supply.

N. 9 connections with 9-pole shielded cable for analog measures.

Type of cable: shielded cable

N. of wires: 9

Diameter of each wire: AWG20÷24 (0.6÷0.22mm²)

Connectors: 9-pole female SUB-D connectors

Connections inside the cable:

Connector	Female SUB-D conn.	Female SUB-D conn.
pin	1 →	1
pin	2 →	2
pin	3 →	3
pin	4 →	4
pin	5 →	5
pin	6 →	6
pin	7 →	7
pin	8 →	8
pin	9 →	9

Connections required:

- from control unit to splitter board in inverter module U1 (control signals, phase U)
- from control unit to splitter board in inverter module V1 (control signals, phase V)
- from control unit to splitter board in inverter module W1 (control signals, phase W)
- from splitter board in inverter module U1 to inverter leg U1 (control signals, phase U1)
- from splitter board in inverter module V1 to inverter leg V1 (control signals, phase V1)
- from splitter board in inverter module V1 to inverter leg W1 (control signals, phase W1)
- from splitter board in inverter module U1 to inverter leg U2 (control signals, phase U2)
- from splitter board in inverter module V1 to inverter leg V2 (control signals, phase V2)
- from splitter board in inverter module W1 to inverter leg W2 (control signals, phase W2)

N. 10 connections with unipolar, twisted pair cables type AWG17-18 (1mm²), for AC low voltage supply to the electronic boards (N. 11 connections if an optional braking unit is connected).

Connections required:

- from auxiliary power supply unit 1 to the driver boards in each power leg 1 (from the power supply unit to the driver board in inverter leg U1, from this driver board to the next in inverter leg V1, from this driver board to the next in inverter leg W1) (+24V power supply to IGBT driver boards)
- from driver board in inverter leg W1 to optional braking unit BU[*] (+24V power supply to braking unit)
- from auxiliary power supply unit 2 to the driver boards in each power leg 2 (from the power supply unit to the driver board in inverter leg U2, from this driver board to the next in inverter leg V2, from this driver board to the next in inverter leg W2) (+24V power supply to IGBT driver board)
- from auxiliary power supply unit 1 to splitter boards (+24V power supply to splitter boards) (from the power supply unit to splitter board in inverter leg U1, from this splitter board to the next in inverter leg V1, from this splitter board to the next in inverter leg W1)
- from splitter board in inverter module W1 to control unit (+24V power supply to control unit)



N. 13 optical fibre connections, 1mm, standard single plastic material (typical damping 0.22dB/m), with connectors type Agilent HFBR-4503/4513 (see Figure 8) (N. 15 connections if an optional braking unit is installed).

Connections required:

- from control unit to splitter board in inverter leg U1 (fault signal U)
- from control unit to splitter board in inverter leg V1 (fault signal V)
- from control unit to splitter board in inverter leg W1 (fault signal W)
- from control unit to optional braking unit BU[*] (Braking unit fault signal)
- from control unit to optional braking unit BU[*] (Braking unit gate signal)
- from splitter board in inverter module U1 to inverter leg U1 (fault signal U1)
- from splitter board in inverter module V1 to inverter leg V1 (fault signal V1)
- from splitter board in inverter module W1 to inverter leg W1 (fault signal W1)
- from splitter board in inverter module U1 to inverter leg U2 (fault signal U2)
- from splitter board in inverter module V1 to inverter leg V2 (fault signal V2)
- from splitter board in inverter module W1 to inverter leg W2 (fault signal W2)
- from control unit to bus voltage reading control board mounted on inverter leg V1 (signal VB)
- from control unit to bus voltage reading control board mounted on inverter leg U1 (sense signal U)
- from control unit to bus voltage reading control board mounted on inverter leg V1 (sense signal V)
- from control unit to bus voltage reading control board mounted on inverter leg W1 (sense signal W)

N. 9 optical fibre connections, 1mm, standard double plastic material (typical damping: 0.22dB/m), with connectors type Agilent HFBR-4516 (see Figure 9).

Connections required:

- from control unit to splitter board in inverter leg U1 (gate signal U)
- from control unit to splitter board in inverter leg V1 (gate signal V)
- from control unit to splitter board in inverter leg W1 (gate signal W)
- from splitter board in inverter module U1 to inverter leg U1 (gate signal, phase U1)
- from splitter board in inverter module V1 to inverter leg V1 (gate signal, phase V1)
- from splitter board in inverter module W1 to inverter leg W1 (gate signal, phase W1)
- from splitter board in inverter module U1 to inverter leg U2 (gate signal, phase U2)
- from splitter board in inverter module V1 to inverter leg V2 (gate signal, phase V2)
- from splitter board in inverter module W1 to inverter leg W2 (gate signal, phase W2)



NOTE The braking units are optional.



NOTE [*] The internal wiring for the dual configuration of the braking units is given in section 2.5.

2.4.1. INTERNAL WIRING FOR S74

2.4.1.1. COPPER CABLE CONNECTIONS

Signal	Type of connection	Cable marking	From	Board	Connector	To	Board	Connector
Control signals, phase U	9-Pole shielded cable	C-U	Control unit	ES842	CN14	Phase U1	ES887	CN15
Control signals, phase V	9-Pole shielded cable	C-V	Control unit	ES842	CN11	Phase V1	ES887	CN15
Control signals, phase W	9-Pole shielded cable	C-W	Control unit	ES842	CN8	Phase W1	ES887	CN15
Control signals, phase U1	9-Pole shielded cable	C-U1	Phase U1	ES887	CN16	Phase U1	ES841	CN3
Control signals, phase V1	9-Pole shielded cable	C-V1	Phase V1	ES887	CN16	Phase V1	ES841	CN6
Control signals, phase W1	9-Pole shielded cable	C-W1	Phase W1	ES887	CN16	Phase W1	ES841	CN6
Control signals, phase U2	9-Pole shielded cable	C-U2	Phase U1	ES887	CN17	Phase U2	ES841	CN6
Control signals, phase V2	9-Pole shielded cable	C-V2	Phase V1	ES887	CN17	Phase V2	ES841	CN6
Control signals, phase W2	9-Pole shielded cable	C-W2	Phase W1	ES887	CN17	Phase W2	ES841	CN6



Signal	Type of connection	Cable marking	From	Board	Connector	To	Board	Connector
+24VD Power supply, driver boards ES841, phase U1	Unipolar cable, 1mm ²	24V-GU1	Aux Power Supply 1 in Figure 15	ES840/1	MR1-3	Phase U1	ES841	MR1-1
0VD Power supply, driver boards ES841, phase U1	Unipolar cable, 1mm ²		Aux Power Supply 1 in Figure 15	ES840/1	MR1-4	Phase U1	ES841	MR1-2
+24VD Power supply, driver boards ES841, phase V1	Unipolar cable, 1mm ²	24V-GV1	Phase U1	ES841	MR1-3	Phase V1	ES841	MR1-1
0VD Power supply, driver boards ES841, phase V1	Unipolar cable, 1mm ²		Phase U1	ES841	MR1-4	Phase V1	ES841	MR1-2
+24VD Power supply, driver boards ES841, phase W1	Unipolar cable, 1mm ²	24V-GW1	Phase V1	ES841	MR1-3	Phase W1	ES841	MR1-1
0VD Power supply, driver boards ES841, phase W1	Unipolar cable, 1mm ²		Phase V1	ES841	MR1-4	Phase W1	ES841	MR1-2
+24V Power supply for BU [*]	Unipolar cable, 1mm ²	24V-BU	Phase W1	ES841	MR1-3	BU	ES841	MR1-1
0V Power supply for BU [*]	Unipolar cable, 1mm ²		Phase W1	ES841	MR1-4	BU	ES841	MR1-2
+24VD Power supply, driver boards ES841, phase U2	Unipolar cable, 1mm ²	24V-GU2	Aux Power Supply 2 in Figure 15	ES840/1	MR1-3	Phase U2	ES841	MR1-1
0VD Power supply, driver boards ES841, phase U2	Unipolar cable, 1mm ²		Aux Power Supply 2 in Figure 15	ES840/1	MR1-4	Phase U2	ES841	MR1-2
+24VD Power supply, driver boards ES841, phase V2	Unipolar cable, 1mm ²	24V-GV2	Phase U2	ES841	MR1-3	Phase V2	ES841	MR1-1
0VD Power supply, driver boards ES841, phase V2	Unipolar cable, 1mm ²		Phase U2	ES841	MR1-4	Phase V2	ES841	MR1-2
+24VD Power supply, driver boards ES841, phase W2	Unipolar cable, 1mm ²	24V-GW2	Phase V2	ES841	MR1-3	Phase W2	ES841	MR1-1
0VD Power supply, driver boards ES841, phase W2	Unipolar cable, 1mm ²		Phase V2	ES841	MR1-4	Phase W2	ES841	MR1-2
+24V Power supply, driver boards ES841, phase U	Unipolar cable, 1mm ²	24V-SU	Aux Power Supply 1 in Figure 15	ES840/1	MR1-1	Phase U1	ES887	MR1-1
0V Power supply, driver boards ES841, phase U	Unipolar cable, 1mm ²		Aux Power Supply 1 in Figure 15	ES840/1	MR1-2	Phase U1	ES887	MR1-2
+24V Power supply, splitter board, phase V	Unipolar cable, 1mm ²	24V-SV	Phase U1	ES887	MR1-3	Phase V1	ES887	MR1-1
0V Power supply, splitter board, phase V	Unipolar cable, 1mm ²		Phase U1	ES887	MR1-4	Phase V1	ES887	MR1-2
+24V Power supply, splitter board, phase W	Unipolar cable, 1mm ²	24V-SW	Phase V1	ES887	MR1-3	Phase W1	ES887	MR1-1
0V Power supply, splitter board, phase W	Unipolar cable, 1mm ²		Phase V1	ES887	MR1-4	Phase W1	ES887	MR1-2
+24V Control unit power supply	Unipolar cable, 1mm ²	24V-C	Phase W1	ES887	MR1-3	Control unit	ES842	MR1-1
0V Control unit power supply	Unipolar cable, 1mm ²		Phase W1	ES887	MR1-4	Control unit	ES842	MR1-2



NOTE The braking units are optional.



NOTE [*] The internal wiring for the dual configuration of the braking units is given in section 2.5.

2.4.1.2. OPTICAL FIBRE CONNECTIONS

Signal	Type of connection	Cable marking	From	Board	Connector	To	Board	Connector
IGBT command, phase U	double optical fibre	G-U	Control unit	ES842	OP19-OP20	Phase U1	ES887	CN9-CN10
IGBT command, phase V	double optical fibre	G-V	Control unit	ES842	OP13-OP14	Phase V1	ES887	CN9-CN10
IGBT command, phase W	double optical fibre	G-W	Control unit	ES842	OP8-OP9	Phase W1	ES887	CN9-CN10
IGBT command, phase U1	double optical fibre	G-U1	Phase U1	ES887	CN1-CN4	Phase U1	ES841	OP4-OP5
IGBT command, phase V1	double optical fibre	G-V1	Phase V1	ES887	CN1-CN4	Phase V1	ES841	OP4-OP5
IGBT command, phase W1	double optical fibre	G-W1	Phase W1	ES887	CN1-CN4	Phase W1	ES841	OP4-OP5
IGBT command, phase U2	double optical fibre	G-U2	Phase U1	ES887	CN2-CN5	Phase U2	ES841	OP4-OP5
IGBT command, phase V2	double optical fibre	G-V2	Phase V1	ES887	CN2-CN5	Phase V2	ES841	OP4-OP5
IGBT command, phase W2	double optical fibre	G-W2	Phase W1	ES887	CN2-CN5	Phase W2	ES841	OP4-OP5

Signal	Type of connection	Cable marking	From	Board	Connector	To	Board	Connector
IGBT fault, phase U	single optical fibre	FA-U	Control unit	ES842	OP15	Phase U1	ES887	CN7
IGBT fault, phase V	single optical fibre	FA-V	Control unit	ES842	OP10	Phase V1	ES887	CN7
IGBT fault, phase W	single optical fibre	FA-W	Control unit	ES842	OP5	Phase W1	ES887	CN7
IGBT fault, phase U1	single optical fibre	FA-U1	Phase U1	ES887	CN11	Phase U1	ES841	OP3
IGBT fault, phase V1	single optical fibre	FA-V1	Phase V1	ES887	CN11	Phase V1	ES841	OP3
IGBT fault, phase W1	single optical fibre	FA-W1	Phase W1	ES887	CN11	Phase W1	ES841	OP3
IGBT fault, phase U2	single optical fibre	FA-U2	Phase U1	ES887	CN12	Phase U2	ES841	OP3
IGBT fault, phase V2	single optical fibre	FA-V2	Phase V1	ES887	CN12	Phase V2	ES841	OP3
IGBT fault, phase W2	single optical fibre	FA-W2	Phase W1	ES887	CN12	Phase W2	ES841	OP3
BU IGBT Fault[*]	single optical fibre	FA-BU	Control unit	ES842	OP3	BU	ES841	OP8
Vbus reading	single optical fibre	VB	Control unit	ES842	OP2	Phase W1	ES843	OP2
IGBT status, phase U	single optical fibre	ST-U	Control unit	ES842	OP16	Phase U1	ES843	OP1
IGBT status, phase V	single optical fibre	ST-V	Control unit	ES842	OP11	Phase V1	ES843	OP1
IGBT status, phase W	single optical fibre	ST-W	Control unit	ES842	OP6	Phase W1	ES843	OP1
BU IGBT Command[*]	single optical fibre	BO-BU	Control unit	ES842	OP4	BU	ES841	OP5



CAUTION

NEVER apply voltage to the equipment if optical fibre connectors are disconnected.



NOTE

The braking units are optional.



NOTE

[*] The internal wiring for the dual configuration of the braking units is given in section 2.5.

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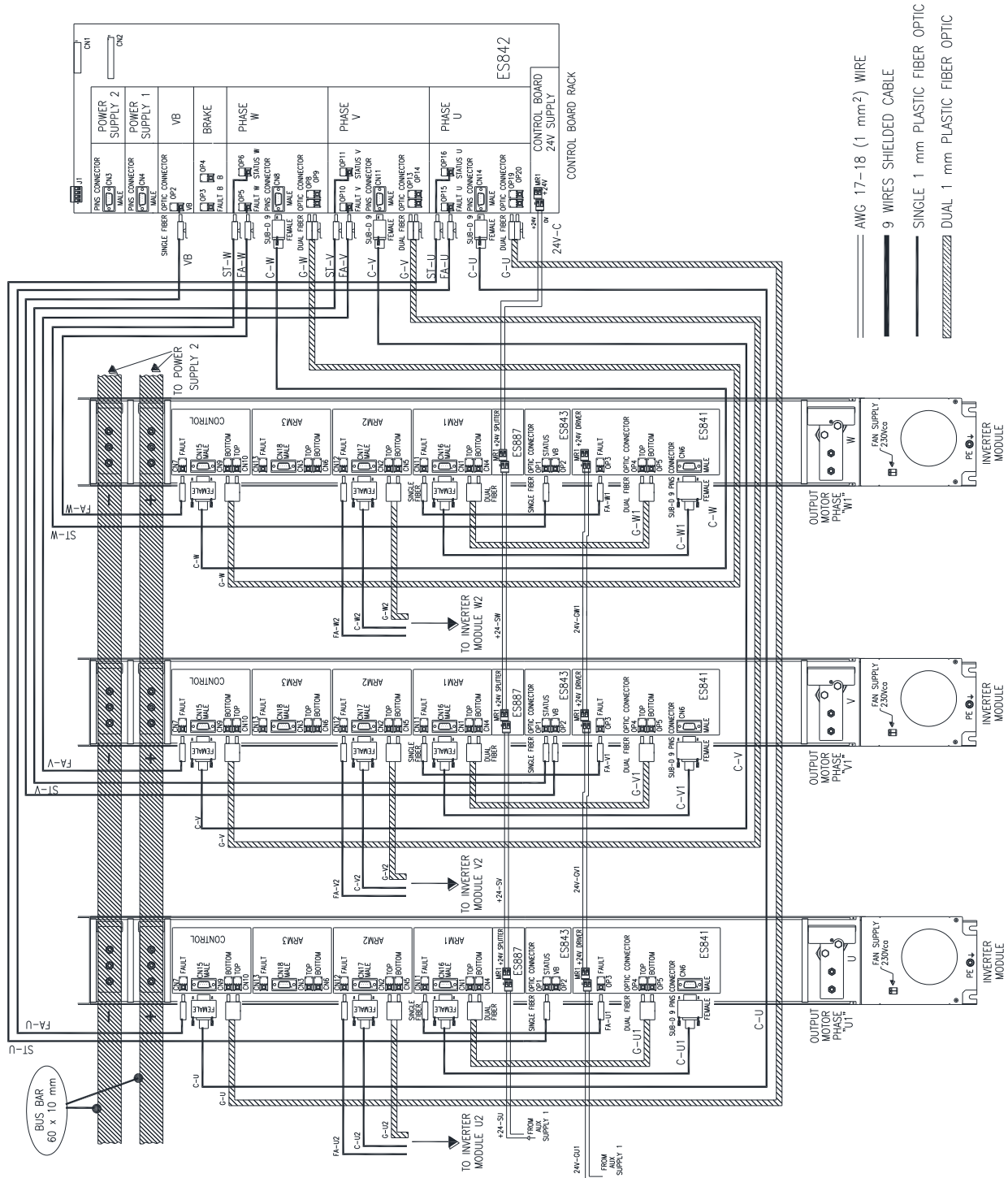
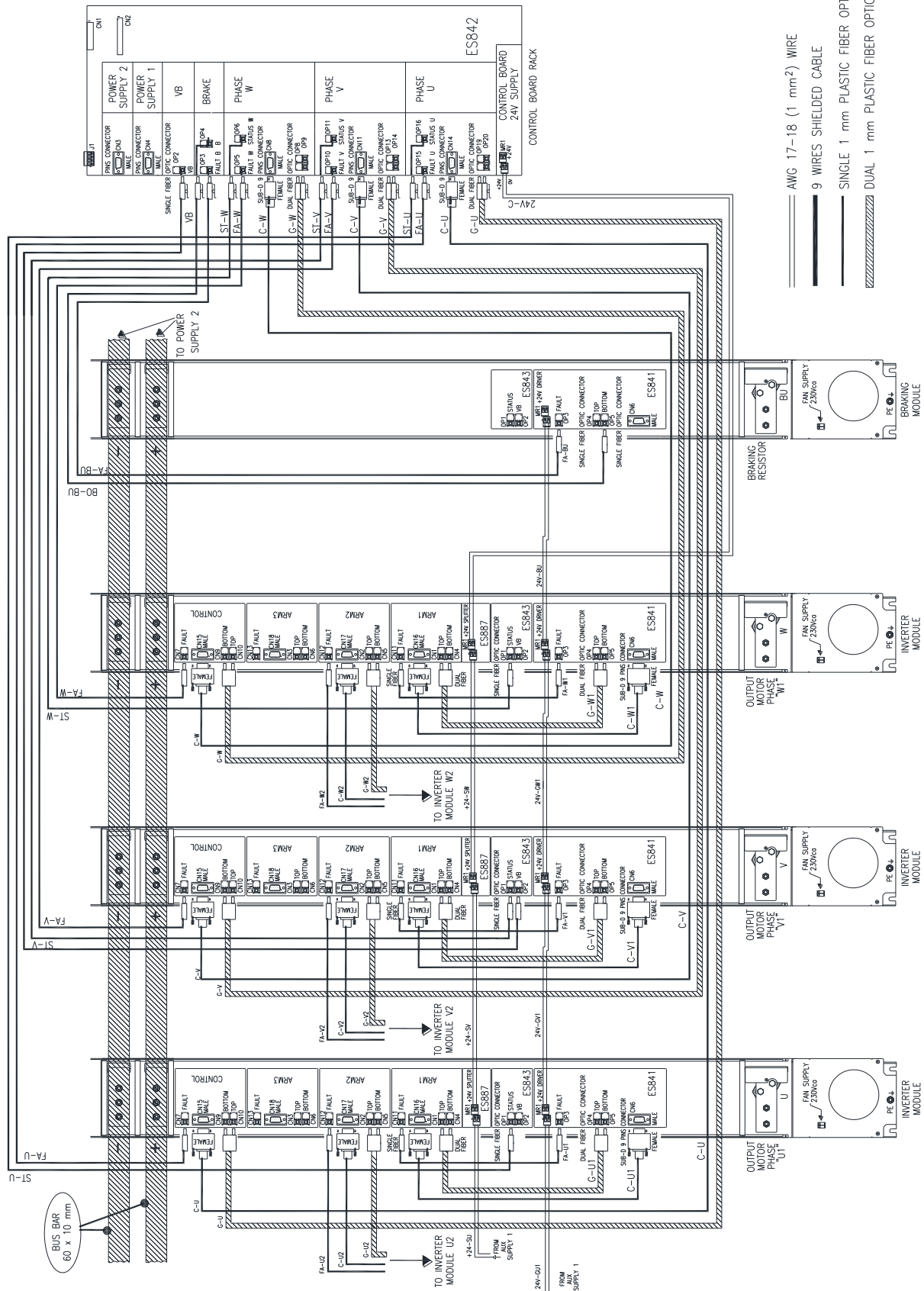


Figure 13: Internal wiring for S74 (Inverter modules U1/V1/W1)

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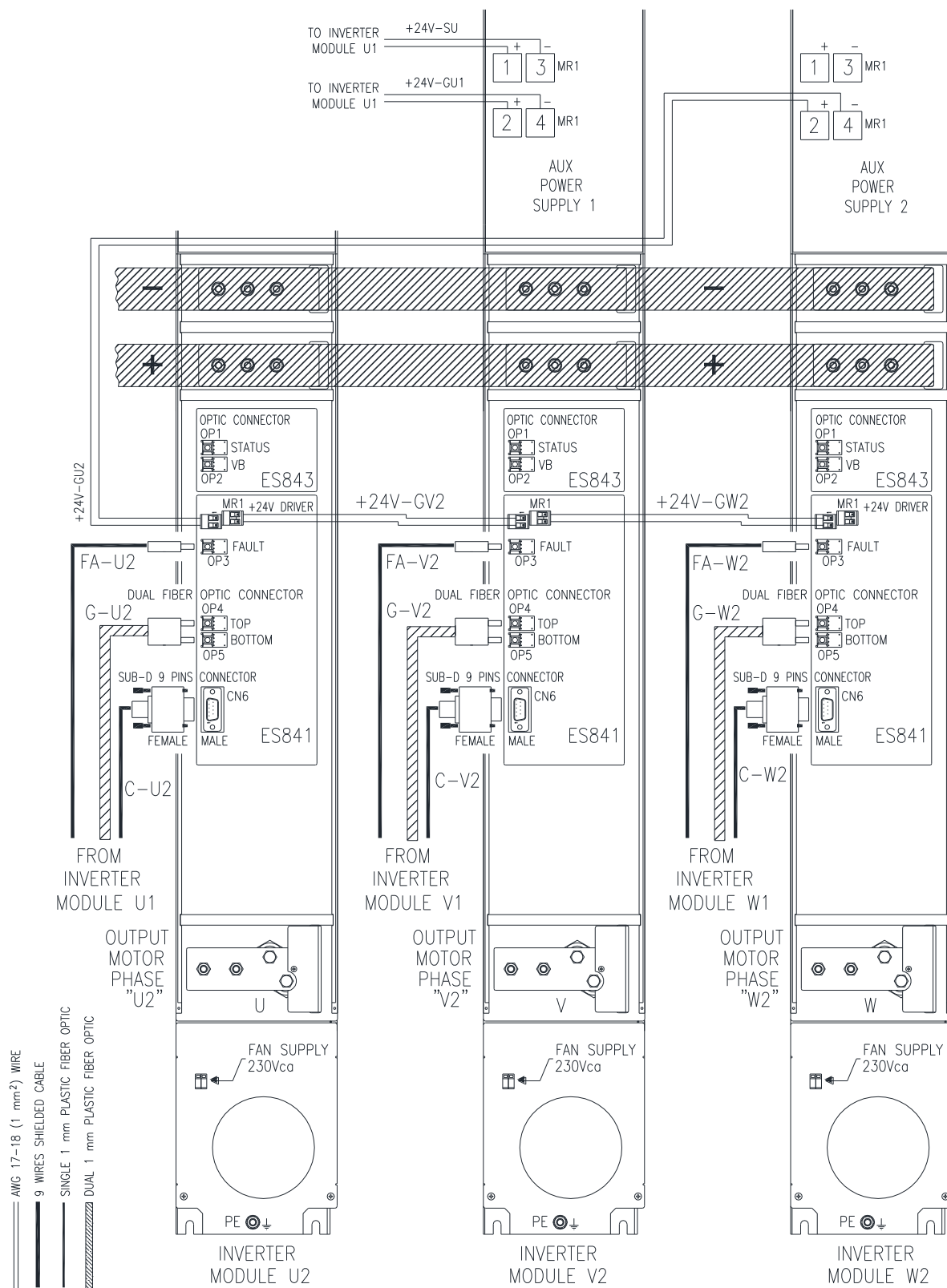


Figure 15: Internal wiring for S74 (Inverter modules U2/V2/W2)

2.5. Internal Wiring for the Dual Configuration of the Braking Units

The dual-configuration braking units may be applied to any type of inverter modules mentioned in section 1. The connections required for the parallel connection of two braking units by means of one splitter boards are as follows:

N. 2 power connections with copper bar 60*10mm for DC supply.

N. 3 connections with unipolar, twisted pair cables AWG 17-18 (1mm²) for the connection of the low-voltage DC supply to the electronic boards.

Connections required:

- from splitter board in inverter leg W to splitter board in braking unit BU1 (power supply +24-BU splitter board)
- from driver board in inverter leg W to driver board in braking unit BU1 (power supply +24-BU1 driver board)
- from driver board in braking unit BU1 to driver board in braking unit BU2 (power supply +24-BU2 driver board).

N. 6 optical fibre connections, 1mm, standard single plastic material (typical damping: 0.22dB/m), with connectors type Agilent HFBR-4503/4513.

Connections required:

- from splitter board in braking unit BU1 to control unit (fault signal BU)
- from control unit to splitter board in braking unit BU1 (gate signal BU)
- from driver board in braking unit BU2 to splitter board in braking unit BU1 (fault signal BU2)
- from splitter board in braking unit BU1 to driver board in braking unit BU2 (gate signal BU2)
- from driver board in braking unit BU1 to splitter board in braking unit BU1 (fault signal BU1)
- from splitter board in braking unit BU1 to driver board in braking unit BU1 (gate signal BU1)



2.5.1. INTERNAL WIRING FOR BRAKING UNITS BU

2.5.1.1. COPPER CABLE CONNECTIONS

Signal	Type of connection	Cable marking	From	Board	Connector	To	Board	Connector
+24V Power supply, splitter board BU1	Unipolar cable 1mm ²	+24-BU	Phase W	ES887	MR1-3	BU1	ES887	MR1-1
0V Power supply, splitter board BU1	Unipolar cable 1mm ²		Phase W	ES887	MR1-4	BU1	ES887	MR1-2
+24V Power supply, driver board BU1	Unipolar cable 1mm ²	+24-BU1	Phase W	ES841	MR1-3	BU1	ES841	MR1-1
0V Power supply, driver board BU1	Unipolar cable 1mm ²		Phase W	ES841	MR1-4	BU1	ES841	MR1-2
+24V Power supply, driver board BU2	Unipolar cable 1mm ²	24V-BU2	BU1	ES841	MR1-3	BU2	ES841	MR1-1
0V Power supply, driver board BU2	Unipolar cable 1mm ²		BU1	ES841	MR1-4	BU2	ES841	MR1-2

2.5.1.2. OPTICAL FIBRE CONNECTIONS

Signal	Type of connection	Cable marking	From	Board	Connector	To	Board	Connector
BU IGBT Fault	Single optical fibre	FA-BU	BU1	ES887	CN7	Control unit	ES842	OP3
BU IGBT Command	Single optical fibre	BO-BU	Control unit	ES842	OP4	BU1	ES887	CN9
BU1 IGBT Fault	Single optical fibre	FA-BU1	BU1	ES841	OP3	BU1	ES887	CN11
BU2 IGBT Fault	Single optical fibre	FA-BU2	BU2	ES841	OP3	BU1	ES887	CN12
BU1 IGBT Command	Single optical fibre	G-BU1	BU1	ES887	CN4	BU1	ES841	OP5
BU2 IGBT Command	Single optical fibre	G-BU2	BU1	ES887	CN5	BU2	ES841	OP5

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Do the following to carry out the internal wiring:

- 1) Gain access to boards ES840/1, ES841 and ES843. The first board is located on the front part of the supply module; the remaining two boards are located on the front part of each inverter module. Remove the front covers made of Lexan by loosening the cover fastening screws.

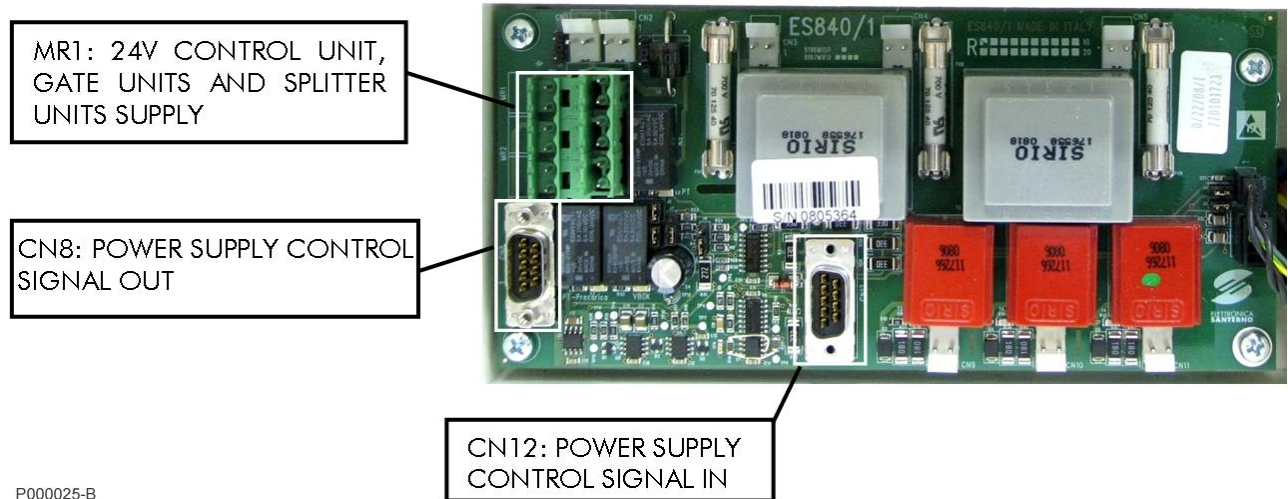


Figure 17: ES840/1 Control board for the power supply unit

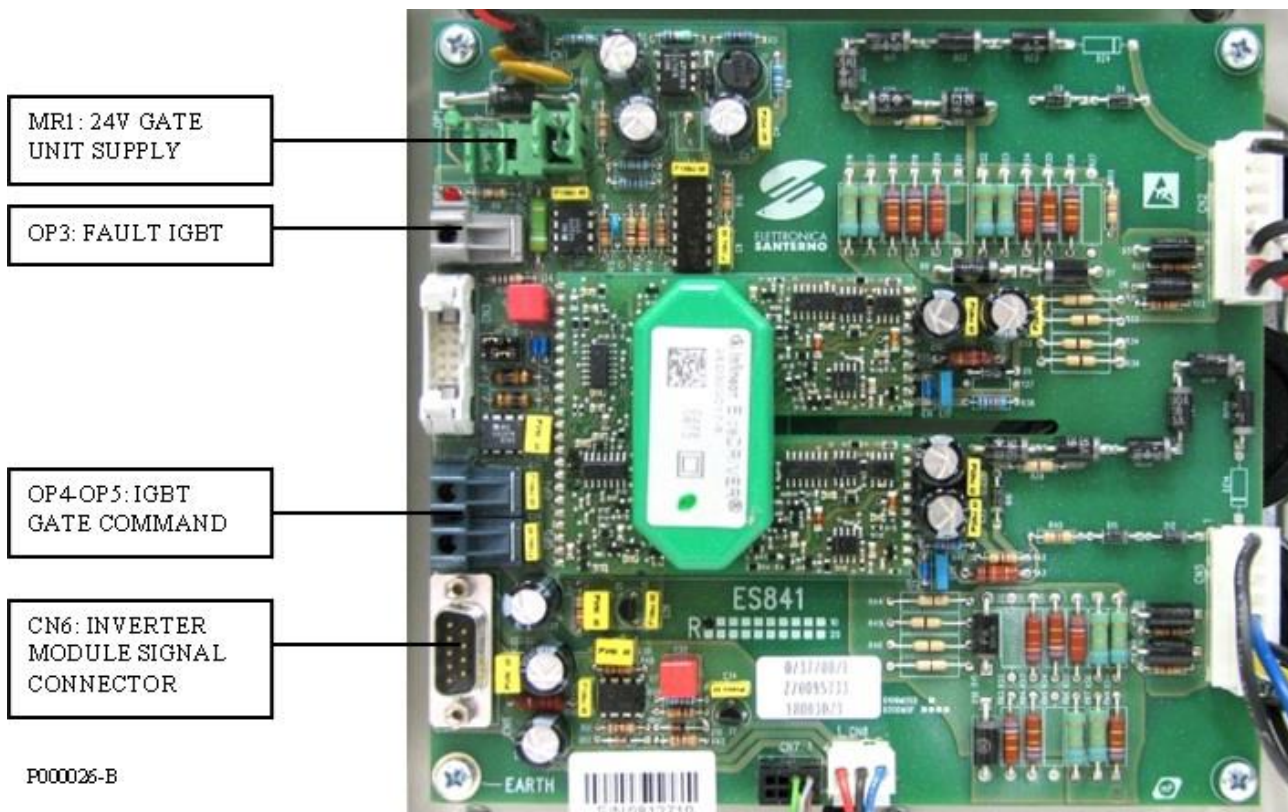


Figure 18: The ES841 Gate Unit board for inverter modules

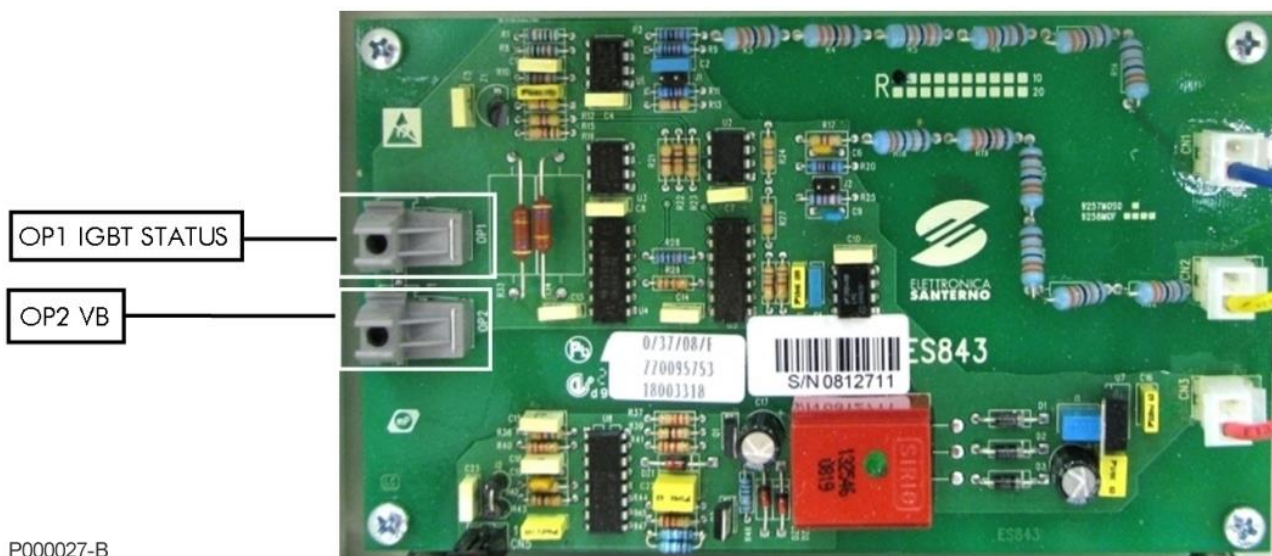


Figure 19: The ES843 board for inverter modules

- 2) Do the following to gain access to ES842 board located on the control unit:
- remove the keypad, if fitted (see Removing the Display/Keypad section in the Sinus Penta's Installation Instructions manual)
 - remove the cover of the terminal board after removing its fastening screws
 - remove the cover of the control unit after removing its fastening screws

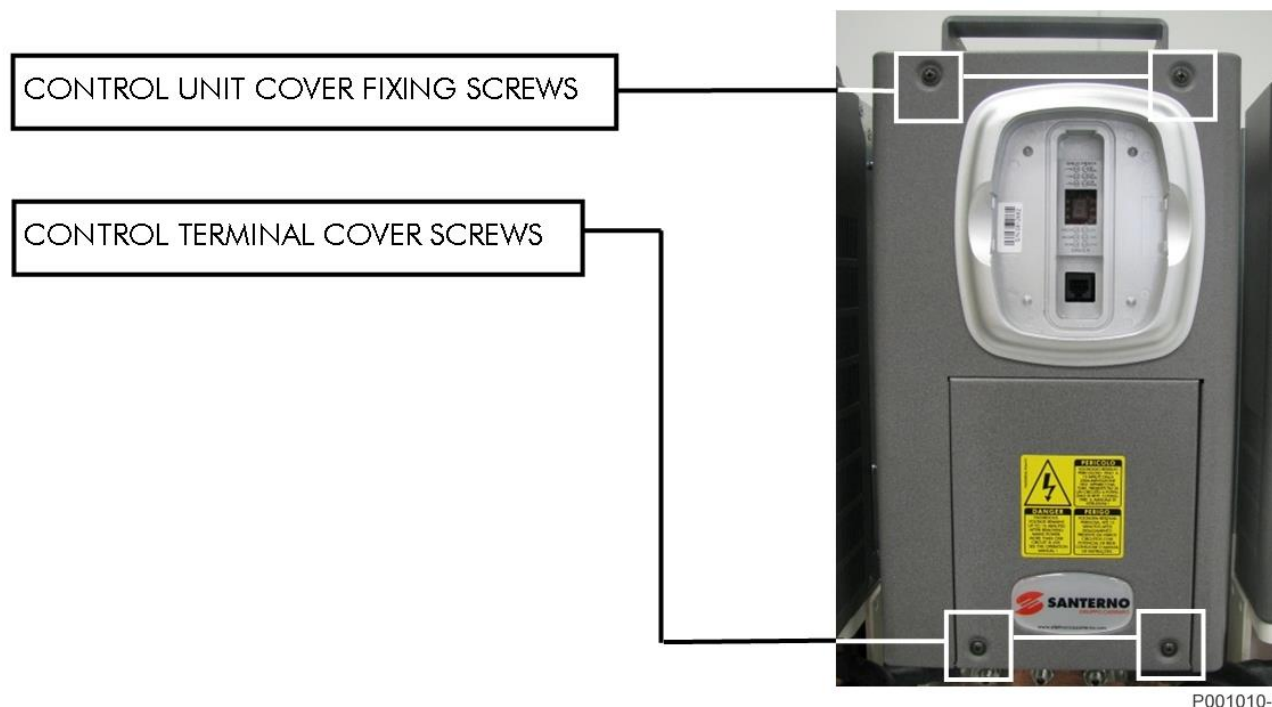
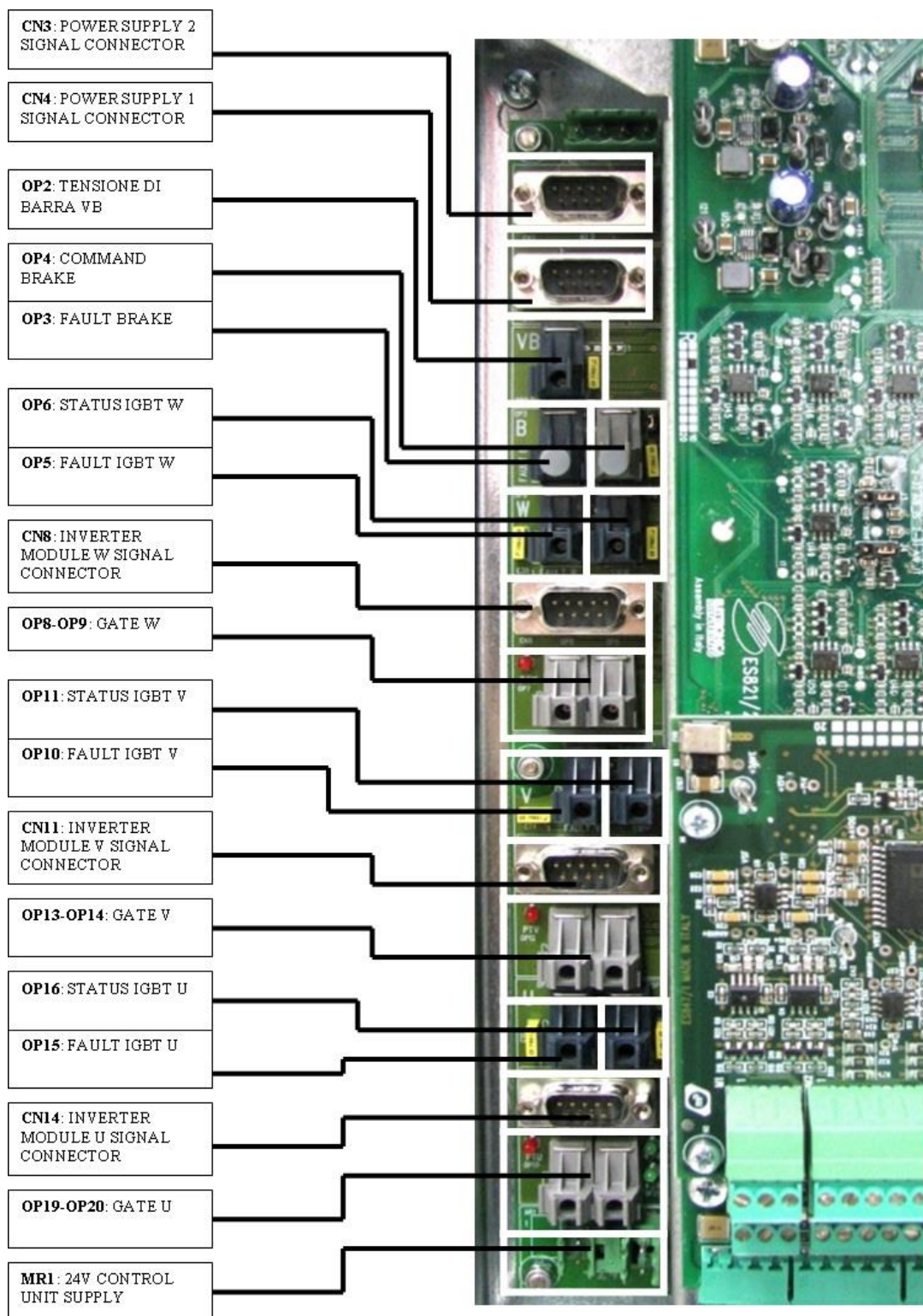


Figure 20: Position of the terminal cover fixing screws and the control unit fixing screws.

2) You can then reach the connectors in ES842 interface board.



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Figure 21: The ES842 interface board

- 4) Reach the ES887 boards installed on the border of inverter modules U1, V1, W1;
remove the covers of the splitter unit after removing the fastening screws.

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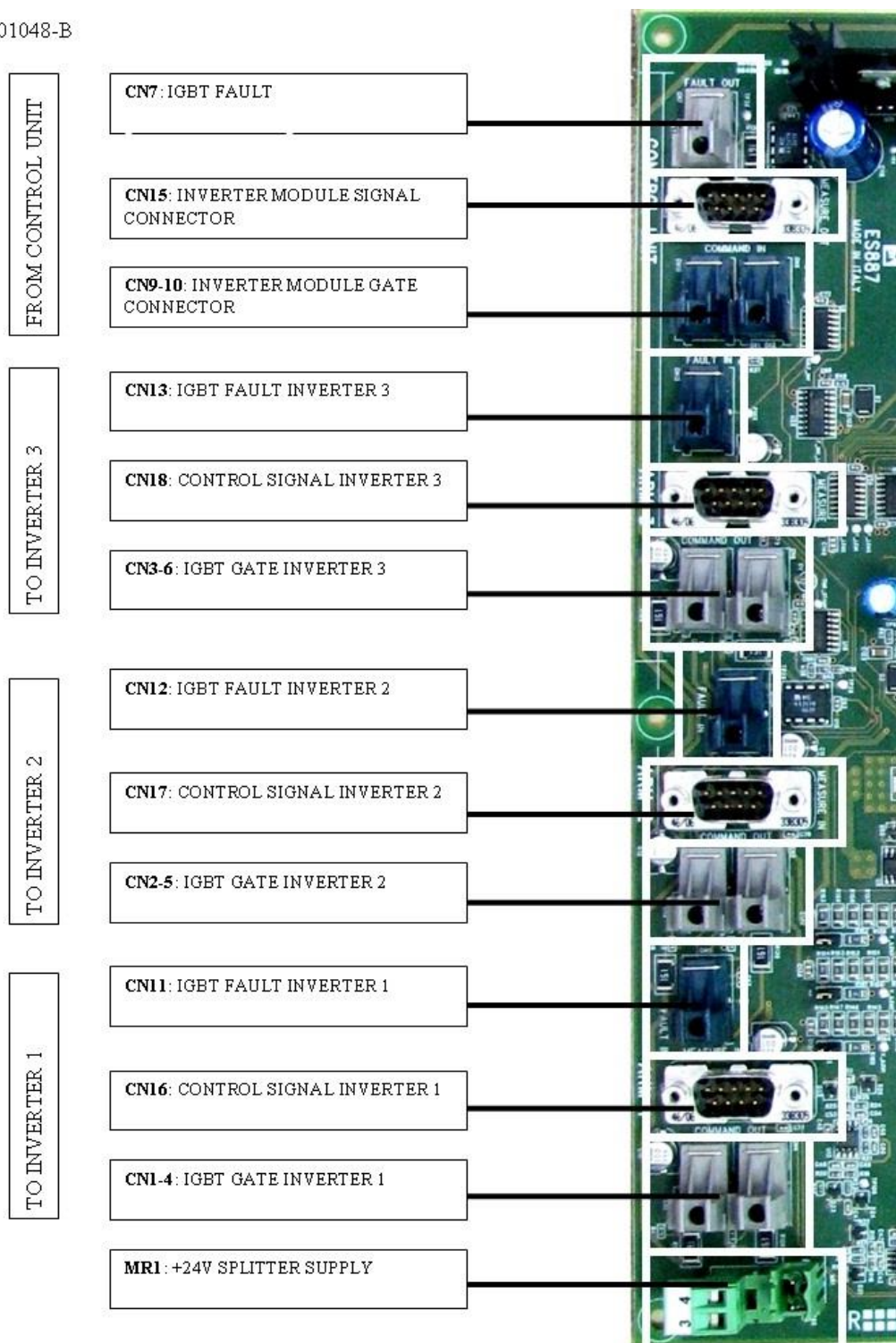


Figure 22: The ES887 Splitter board

- 5) Use the connection cable kit to connect the inverter components to each other.
- 6) Reassemble the covers made of Lexan and the covering of the control unit, making sure not to flatten any cable/optical fibre.



2.6. Board Configuration by Use

Make sure that boards ES840/1, ES842, ES887 are set up for proper operation based on the configuration of the inverter where they are installed on.

2.6.1. CONFIGURATION FOR ES840/1

Make sure that the jumpers on the board are properly set up:

- Power supply voltage:

	J7	J8
4T	pos: 1-2	pos:1-2
5T-6T	pos: 2-3	pos: 2-3

- Serial link, connector CN8:

	J1	J2
Connected	OFF	OFF
Not connected	ON	ON

- Serial link, connector CN12:

	J3	J4
Connected	OFF	OFF
Not connected	ON	ON

- Master/Slave configuration:

The Master/Slave configuration of the ES840/1 board shall be the same as the Master/Slave configuration of the power supply units where it is installed on.

The power supply unit that is connected directly to the ES842 board (i.e. the first in the chain) shall have the Master configuration; consequently, its ES840/1 board shall be set up as the Master.

	J5	J6
Master	ON	ON
Slave	OFF	OFF

Example: Configuration for Sinus Penta S80 4T [see Figure 10 and Figure 11].

	J1/J2	J3/J4	J5/J6	J7/J8
ES840/1 Power Supply 1	OFF	OFF	ON	pos:1-2
ES840/1 Power Supply 2	OFF	OFF	OFF	pos: 1-2
ES840/1 Power Supply 3	OFF	ON	OFF	pos: 1-2

2.6.2. CONFIGURATION FOR ES842

Make sure that the jumpers on the ES842 board are properly set up:

JUMPER	J8, J9, J14		J7, J10, J11		J4, J15, J22		J2, J16, J21		J3, J18, J17	
Inverter configur.	Power supply unit 1		Power supply unit 2		Leg "U"		Leg "V"		Leg "W"	
	Fitted	Not fitted	Fitted	Not fitted	Fitted	Not fitted	Fitted	Not fitted	Fitted	Not fitted
Jumper status	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON

JUMPER	J6		J12, J13, J19, J20, J23
Inverter configur.	Brake Legs		Control board
	Fitted	Not fitted	Fitted
Jumper status	OFF	ON	ON

IMPORTANT: "Power supply unit 1" and "Power supply unit 2" of serial ports CN4 and CN3 stand for:

CN4 – Power supply unit 1: The first power supply unit in the chain (FIRST Power Supply 1), set up as the Master (maximum number: 3 cascade-connected power supply units for Sizes S80-S90)

CN3 – Power supply unit 2: The first power supply unit in the second chain for sizes greater than S90. The configuration of this inverter will be the same as the FIRST Power supply 1 set up as the Master.

2.6.3. CONFIGURATION FOR ES887

Make sure that the switches and the jumpers on the ES887 board are properly set up:

SW1&SW2					
Leg 1		Leg 2		Leg 3	
Fitted	Not fitted	Fitted	Not fitted	Fitted	Not fitted
1 = OFF	1 = ON	2 = OFF	2 = ON	3 = OFF	3 = ON
4 = OFF	4 = ON	5 = OFF	5 = ON	6 = OFF	6 = ON

SW3	
1 Leg fitted	1 = OFF 2 = OFF
2 Legs fitted	1 = OFF 2 = ON
3 Legs fitted [default]	1 = ON 2 = ON

Inverter Size	J2, J3, J4	Current LEM full-scale value (2.5V)
1296 [Dual inverter modules]	ON	4800 A/2
2076 [Triple inverter modules]	OFF	6000 A/3

2.7. Indicator LEDs in the ES887 Board

Each of the three splitter boards (ES887) is provided with 14 indicator LEDs.

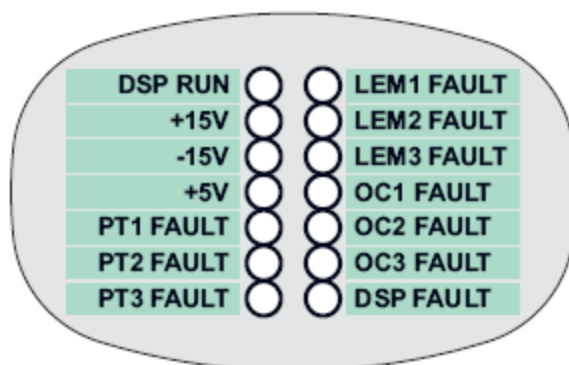


Figure 23: The indicator LEDs in ES887

The indicator LEDs in the ES887 board are detailed below:

LED	Indication	Colour
DSP RUN	Comes on when the system reset is complete	Green
+15V	Comes on when positive 15V supply is applied	Green
-15V	Comes on when negative 15V supply is applied	Green
+5V	Comes on when 5V supply is applied	Green
PT1 FAULT	FAULT of the thermoswitch in leg 1	Red
PT2 FAULT	FAULT of the thermoswitch in leg 2	Red
PT3 FAULT	For future use	Red
LEM1 FAULT	Overcurrent FAULT, leg 1	Red
LEM2 FAULT	Overcurrent FAULT, leg 2	Red
LEM3 FAULT	For future use	Red
OC1 FAULT	Overcurrent Driver FAULT, leg 1	Red
OC2 FAULT	Overcurrent Driver FAULT, leg 2	Red
OC3 FAULT	For future use	Red
DSP FAULT	For future use	Red

3. WIRING ACCESSORIES

The following accessories are standard supplied to contain the signal cables connecting the boards installed on the inverter modules:

- Cable raceways to be installed on the inverter legs (see Figure 24);
- U-bend to link the inverter legs (see Figure 24);
- Junction plates for the inverter sections (see Figure 25);
- Cable raceway covers (see Figure 25);
- Linking tubes for wiring internal to the modules (see Figure 26);
- Bottom covers (see Figure 26);
- Velcro items for cover fastening (see Figure 27);
- Clamps to fasten the mechanical links (see Figure 27);
- Rivets made of plastic to fasten the covers (see Figure 27).

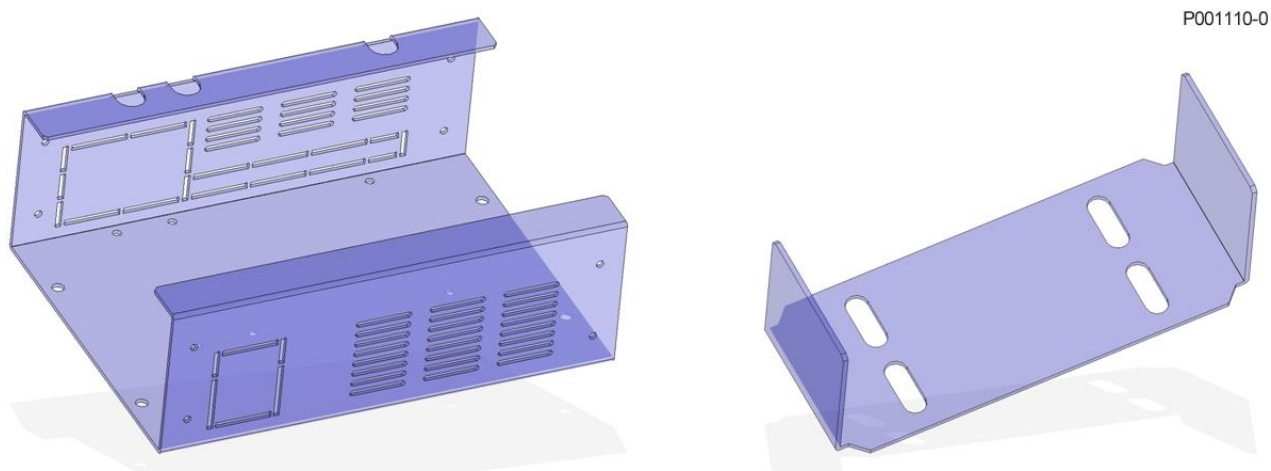


Figure 24: Cable raceway to be installed on the inverter legs (A) and U-bend joining the inverter legs (B)

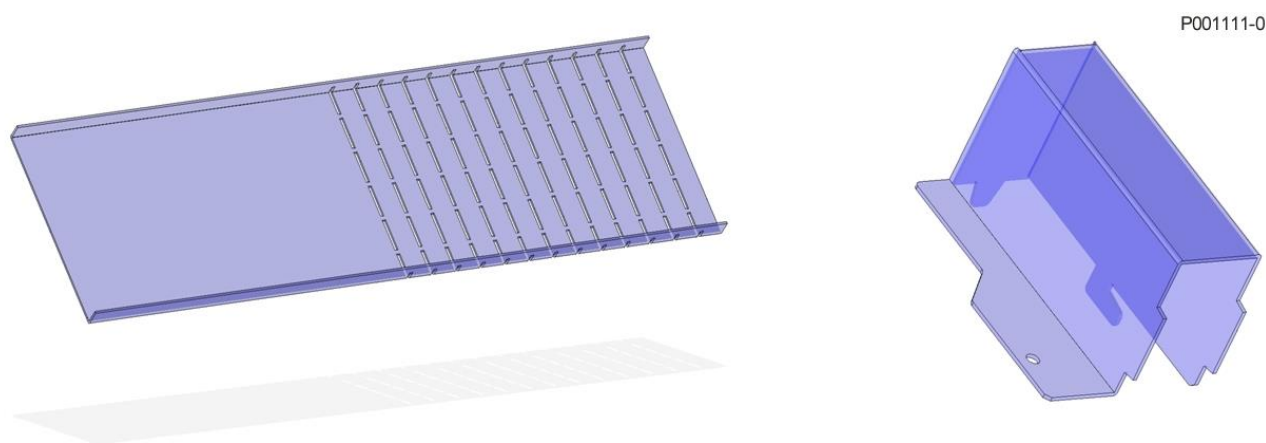
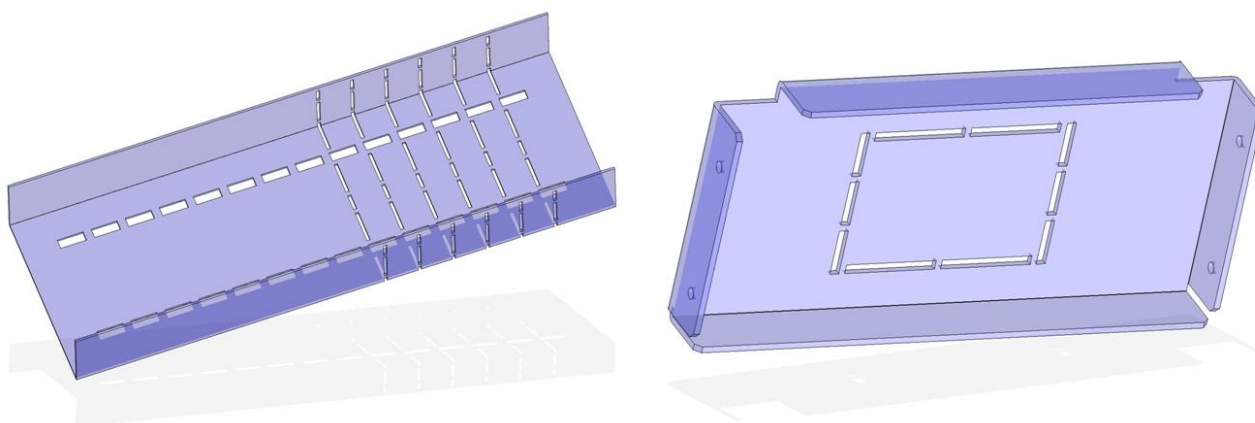
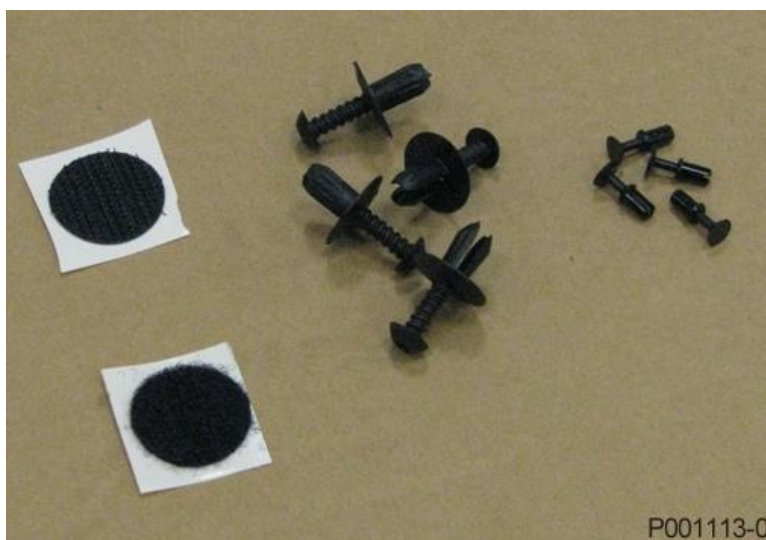


Figure 25: Cable raceway closure cover (C) and linking tube for wiring internal to the modules (D)



P001112-0

Figure 26: Junction plates between the inverter sections (E) and bottom cover (F)



P001113-0

Figure 27: Velcro items to fasten the cover; fasteners to fix the junction plates; rivets to fix the bottom covers

You can mount wiring accessories once you have mounted the power modules and you have fitted the Lexan covers.

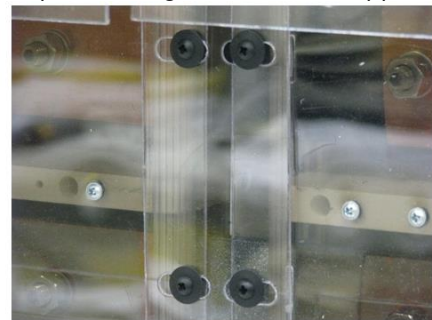
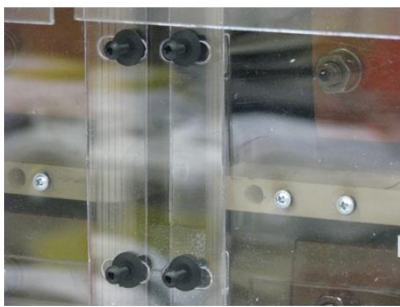
1) Install the cable raceway

Take out the removable parts to allow cable running where required. Fix the cable raceways (A) to the modules forming the inverter using the screws fastening the Lexan sheet covering bars + and -.



Figure 28: Cable raceway installed on the inverter module

2) Install the junction plates between the inverter modules (B) and between the inverter sections (E) (the junction plates are to be fitted using the pre-cut slots). Fix the junction plates using the fasteners supplied.



P001115-0

Figure 29: Junction plates installed between two inverter modules

3) Wire the internal cables.

4) Fit the covers:

- Fit the bottom covers (F) using the rivets;



P001116-0

Figure 30: Assembly of the bottom cover

- Fit the cable raceway bottom covers (C) using the Velcro items;
- Fit the linking tubes (D) where required.



4. REACTORS

4.1. *Three-phase Input Reactors for Modular Inverters S75 and S80*

4.1.1. 4T CLASS – AC LINE REACTORS

INVERTER SIZE	INVERTER MODEL	THREE-PHASE INPUT REACTOR MODEL
S75	0964	2 x IM0126404
	1130	2 x IM0126404
	1296	2 x IM0126444

REACTOR MODEL	USAGE	RATINGS		DIMENSIONS							HOLE	WGT	LOSSES
		mH	A	TYPE	L	H	P	M	E	G			
IM0126404	Input	0.023	945	C	300	320	240	100	250	143	9x24	67	752
IM0126444	Input	0.018	1260	C	360	375	280	120	250	200	12	82	1070

4.1.2. 5T-6T CLASS – AC LINE REACTORS

INVERTER SIZE	INVERTER MODEL	THREE-PHASE INPUT REACTOR MODEL
S75	0964	2 x IM0127404
	1130	2 x IM0127444
S80	1296	3 x IM0127404

REACTOR MODEL	USAGE	RATINGS		DIMENSIONS							HOLE	WGT	LOSSES
		mH	A	TYPE	L	H	P	M	E	G			
IM0127404	Input	0.040	945	C	360	385	260	120	250	200	12	88	1193
IM0127444	Input	0.030	1260	C	420	440	290	140	300	200	12	110	1438

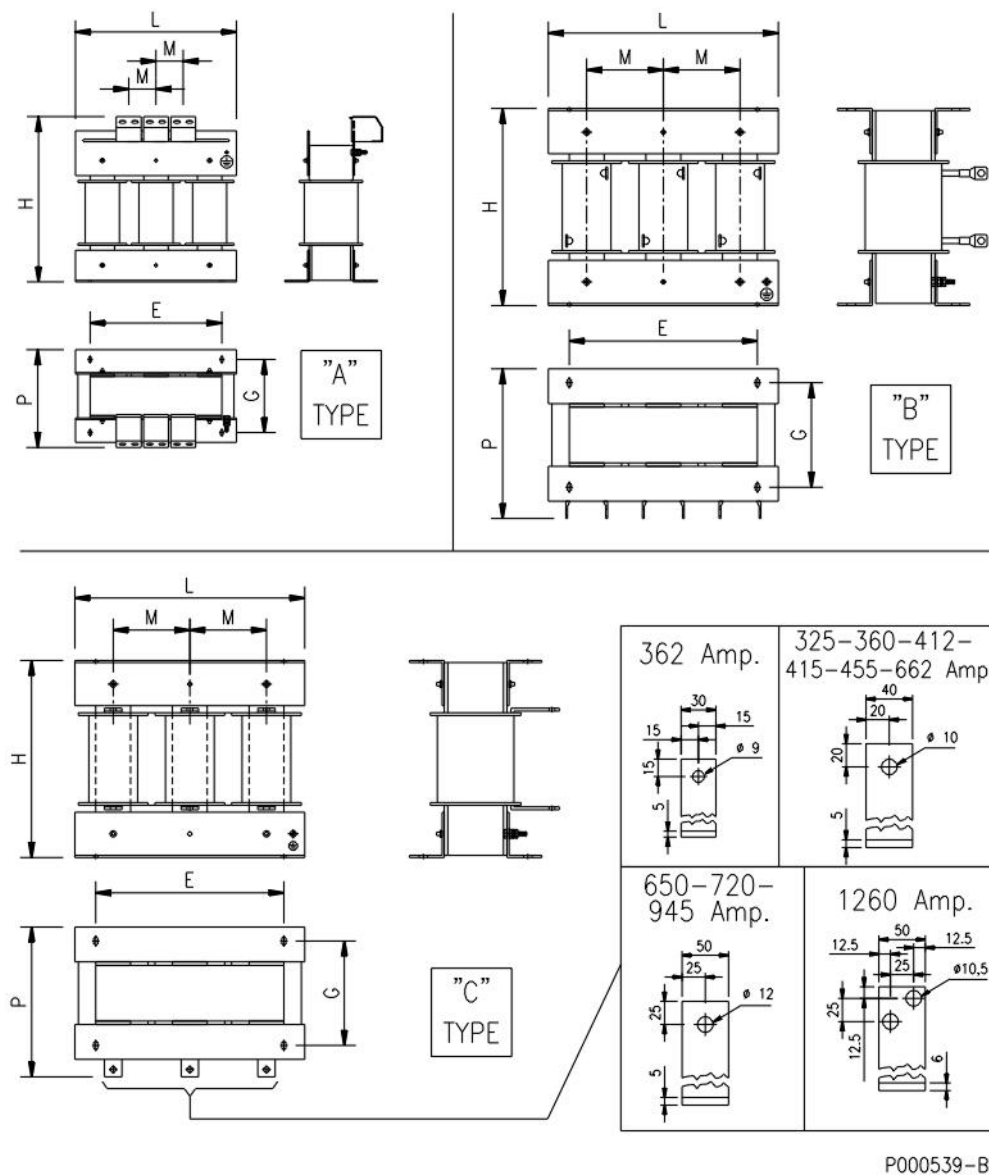
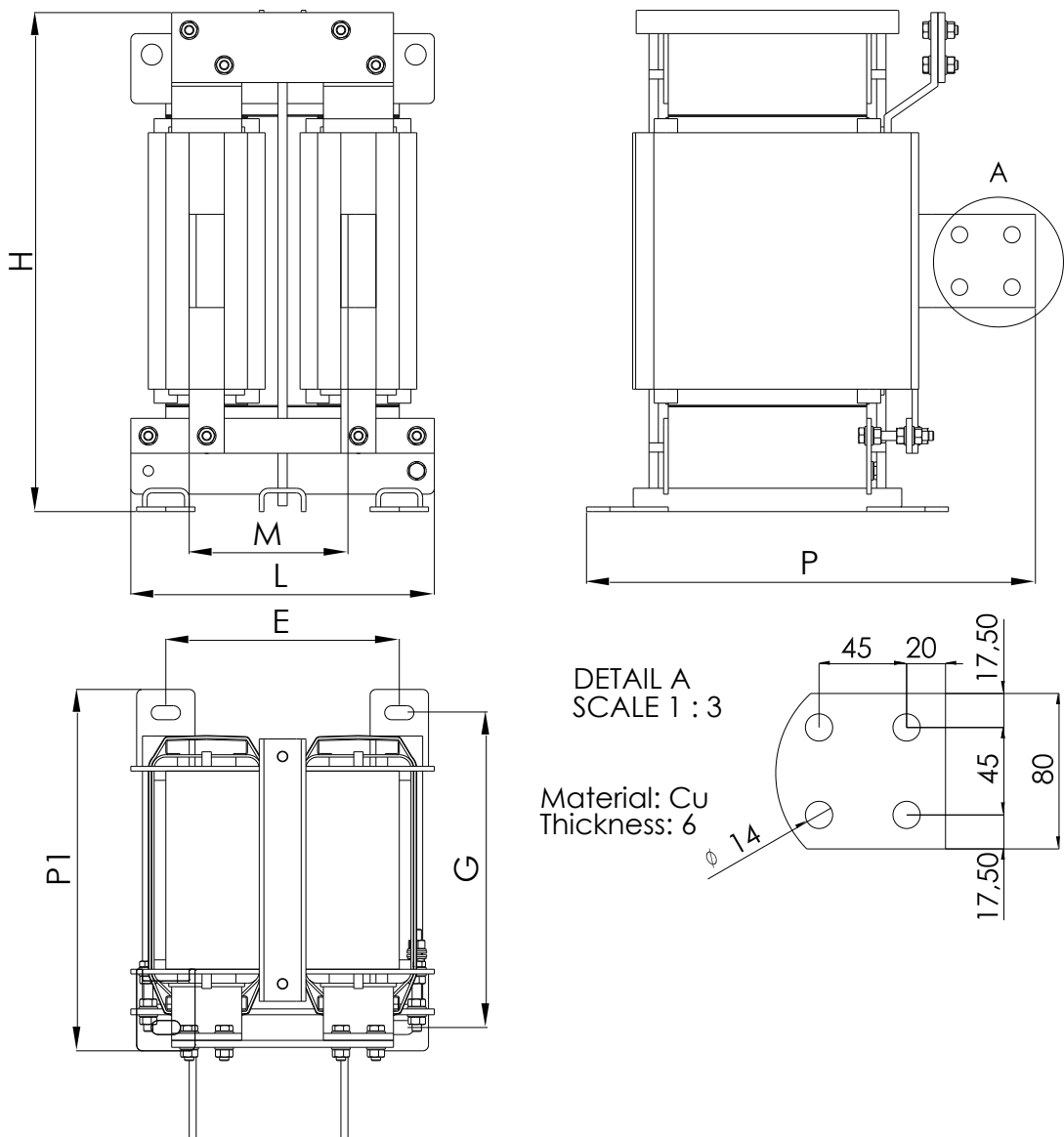


Figure 31: Mechanical features of a 3-phase reactor

4.2. Single-phase Output Reactors for Modular Inverters S75 and S80

4.2.1. 4T, 5T, 6T CLASS – SINGLE-PHASE AC REACTORS

REACTOR MODEL	USAGE	RATINGS		DIMENSIONS							HOLE	WGT	LOSSES
		mH	A	L	H	P1	M	E	G	P	mm	kg	W
IM0141782	Output	0.015	1250	260	430	310	136	200	270	385	9x24	100	940



P000980-B

Figure 32: Mechanical features of the single-phase output reactor