INSTALLATION MANUAL

230V series
400V series

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Review 1.2 / April 2011

i.1 REVIEW

Review	Description and changes
Rev. 1.0/July 2010	First Edition.
Rev. 1.1/January 2011	Introduced *SKYD 400V series*
Rev. 1.2/April 2011	Changed motor tables 4.1.1 and Section 3.2.2 encoder connection part a) and c)

1. WARNING

This manual contains the information necessary for the installation and use of the product, it is therefore to be considered an integral part thereof. For an in-depth of the various topics, please refer to the *Instruction Manual* and to the *application notes* that can be downloaded directly from the site *www.mdmotion.it*.

The manufacturer reserves the right to make any necessary modifications for the technical improvement of the product or of the instruction manual without prior notice or replacement.
The manufacturer assumes no liability arising from incorrect use of the product.

Improper handling of the service may cause damage to persons or property.

Before installing and using all data and the instructions on the product label should be carefully checked and the installation manual and instruction read.

The installation, commissioning and maintenance of the product should be committed only by qualified personnel who have expertise in performing such activities and that have familiarity with current safety standards.

○ *1.1SAFETY DIRECTIONS*

During use the product may present:

- under tension exposed parts
- Control and power connections that may be under tension even with the motor off
- Hot surface

2. POWER AND SIGNAL CONNECTORS

Power and signal connectors of the SKYD service are shown in the following figure.

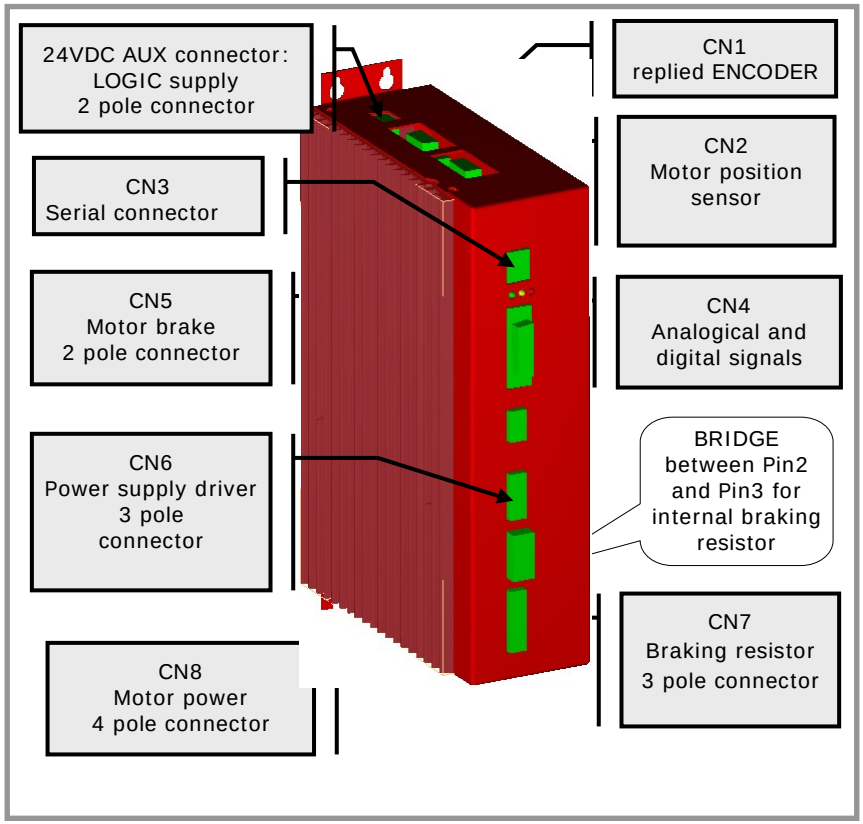


Fig. 2.1.1 SKYD connector service

2.1 POWER CONNECTORS

Power connectors are shown in Fig. 2.1.1.

24VDC AUX: LOGIC Supply

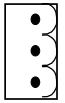
	Pin	Name	Description
	+	24V	24Vdc Supply
	-	0V24V	24Vdc Reference

CN5: Brake Motor



Pin	Name	Description
+	24V	+24V Brake motor Power
-	0V24V	0V Brake motor Power

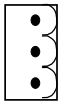
CN6: Drive supply
230Vrms Single phase / Three phase → for the *"230V series"*
400Vrms Three phase → for the "*400V series"*



Pin	Name	Description
R	Fase R	R Phase Supply
S	Fase S	S Phase Supply
T	Fase T	T Phase Supply

NB: for the ***230V series*** the single phase power supply for the Driver can be made using any two phase

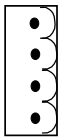
CN7: Brake Resistor



Pin	Name	Description
1	RES EXT	External Resistor
2	COMUNE	Common
3	RES INT	100W Internal Resistor

DEFAULT: Jumper between pins 2 and 3, insert the internal resistance. The external resistor must be connected between Pin1 and Pin2

CN8: Motor Power



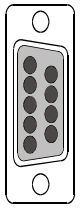
Pin	Name	Description
PE	Terra	Earth
W	Fase W	output phase supply Motor W
V	Fase V	output phase supply Motor V
U	Fase U	output phase supply Motor U

NB: The connection of the Motor phases must be respected.

2.2 SIGNAL CONNECTORS

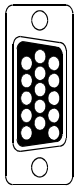
in Fig. 2.1.1 are shown the signal connectors.

CN1: REPLIED ENCODER
9Poles female SubD Connector:



Pin	Name	Description
1	A\	A\ Phase
2	A	A Phase
3	B	B Phase
4	B\	B\ Phase
5	+5VENC	5V Supply
6	Z	Z Phase (Zero)
7	Z\	Z\ Phase (Zero\)
8	--	reserved
9	GND	Ground Reference

CN2: MOTOR FEEDBACK
15Poles female HD Connector SubD



Pin	ENCODER		RESOLVER OPTION	
	Name	Description	Name	Description Signal
1	+VENC	Encoder Supply	- -	Reserved signal
2	A	Phase A Encoder	SEN	Sine signal
3	A\	Phase A\ Encoder	REFSEN	Sine signal Reference
4	B	Phase B Encoder	COS	Cosine signal
5	B\	Phase B\ Encoder	REFCOS	Cosine signal Reference
6	Z	Zero Encoder	- -	Reserved signal
7	Z\	Zero\ Encoder	- -	Reserved signal
8	PTC	Motor thermistor	PTC	Motor thermistor
9	0V	Thermistor Reference	0V	Thermistor Reference
10	U	Phase U Encoder	- -	Reserved signal
11	V	Phase V Encoder	- -	Reserved signal
12	W	Phase W Encoder	- -	Reserved signal
13	0VENC	+VENC Reference	- -	Reserved signal
14	- -	Reserved signal	ECC	ECC Resolver signal
15	--	Reserved signal	REFECC	ECC Resolver Reference

CN3: RS232 LINE (SERIAL)

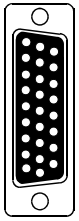
RJ45 Connector

Pin	Name	Description
1	--	Reserved Pin (*)
2	RX	Receiving signal
3	TX	Transmitting signal
4	--	Reserved Pin (*)
5	GND	Reference Signal
6	--	Reserved Pin (*)
7	--	Reserved Pin (*)
8	--	Reserved Pin (*)
9	--	Reserved Pin (*)

(*) **ATTENZIONE: The reserved pin must NOT be connected.**

CN4: SIGNAL

26Poles female HD Connector SubD



Pin	Name	Description
1	+VREF	Analogical differential reference signal of speed/torque, positive
2	-VREF	Analogical differential reference signal of speed/torque, negative
3	ANOUT1 R	ANOUT1 reference ground
4	DOUT1+	Digital output1 + (programmable)
5	DOUT1-	Digital output1 - (programmable)
6	DOUT2+	Digital output2 + (programmable)
7	-	-
8	DTEN	Enable motor's control, digital input.
9	DIEN	Enable speed +/-VREF reference signal, digital input.
10	-	-
11	ATEXREF\	input signal differential analogical programmable ATEXREF, negative.
12	ANOUT1	Programmable analogical output1
13	-	-
14	OK+	Digital Output Drive OK +
15	OK-	Digital Output Drive OK -
16	DOUT2-	Digital output2- (programmable)
17	DIN2	Digital input2 (programmable)
18	DIN1	Digital input1 (programmable)
19	ATEXREF	input signal differential analogical programmable ATEXREF, positive.
20	-	-
21	+VPOT	+10V supply for external potentiometer
22	-VPOT	-10V supply for external potentiometer
23	0V24V	24Vdc reference, digital input ground
24	DIN5	Digital input2 (programmable)
25	DIN3	Digital input2 (programmable)
26	DIN4	Digital input2 (programmable)

3. SKYD ELECTRICAL CONNECTION

3.1 *POWER LINKS: MOTOR and SUPPLY*

The SKYD connection drive are shown in the following figure with a power supply: **230Vac three-phase/single phase** for the **230V series** and the **three-phase 400Vac** for the **400V series**. The power supply of the **24Vdc** logic is the same with the two drive types. As you can see it is not necessary to have an external filter network, since it's present internally in the drive:

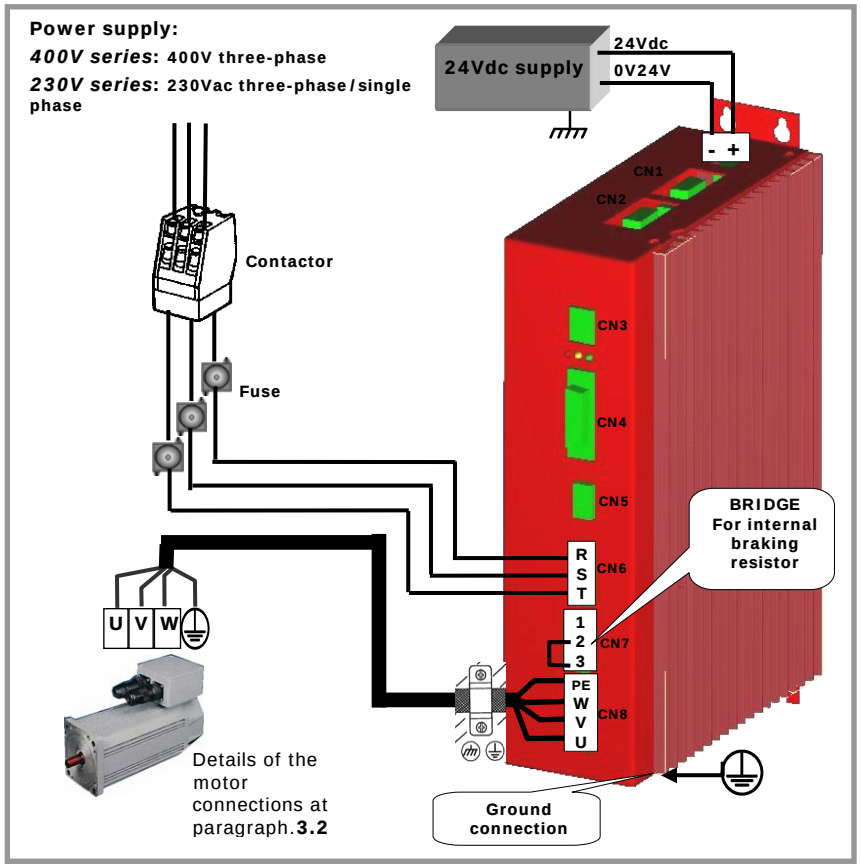


Fig. 3.1.1 power supply for the 230V series and the 400V series SKYD

3.1.1 CONNECTION OF AN EXTERNAL BRAKING RESISTOR TO THE CONNECTOR CN7

If you use an **external braking resistor** it must be connected between pin 1 and 2 of the connector CN7, after removing the bridge between pin 2 and 3, by removing the internal resistor. To calculate the brake resistor, refer to the INSTRUCTION MANUAL.

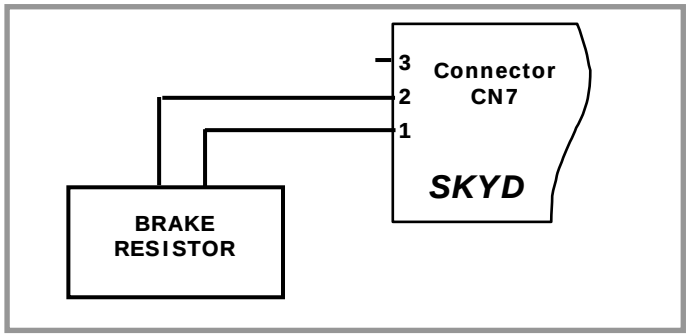


Fig. 3.1.1.1 external resistor connection to the *SKYD* drive

3.2 MOTOR CONNECTION WITH *SKYD*

3.2.1 POWER CONNECTION BETWEEN TEM MOTOR AND CONNECTOR CN8 SKYD

Check documentation enclosed to the motor. The connections between the motor power connector and the drive connector are the following:

a) Motor *BTS* TEM SERIES with connector MOLEX:

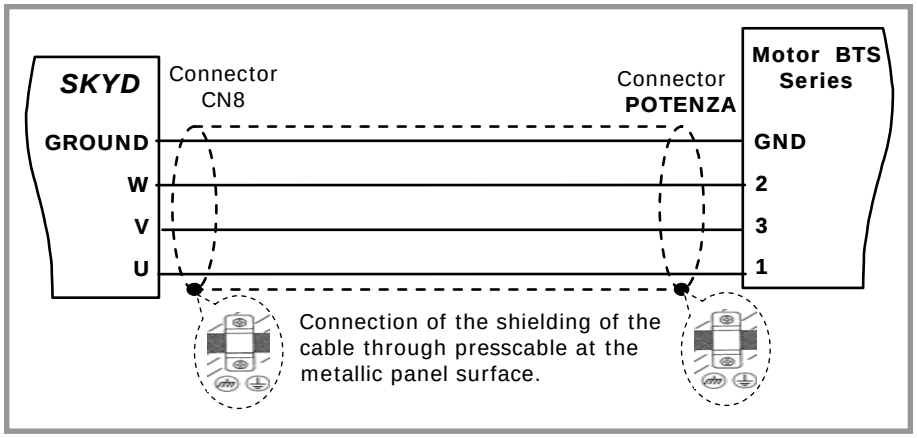


Fig. 3.2.1.1 power connection between motor BTS series and *SKYD* drive

b) Motor *BT* TEM SERIES with power connector:

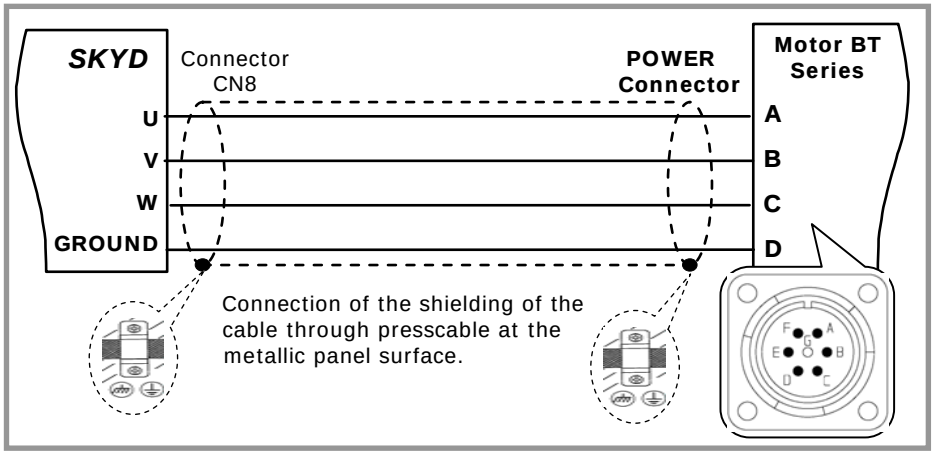


Fig. 3.2.1.2 power connection between BT series motor and *SKYD* drive

c) Motor *BT* TEM Series with power terminal board:

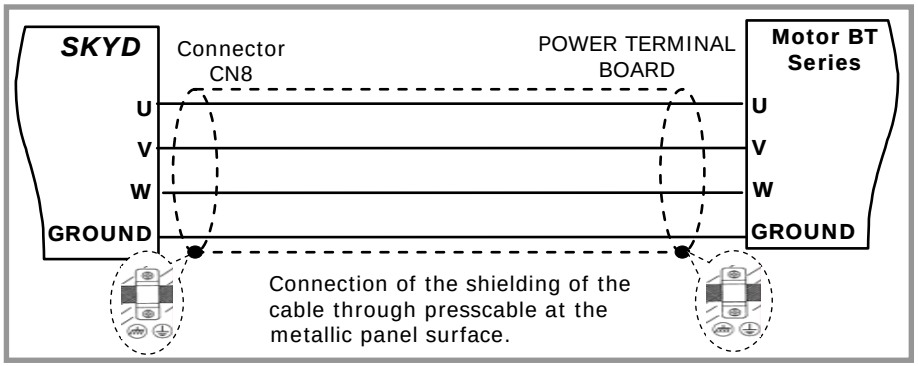


Fig. 3.2.1.3 power connection between motor BT series power terminal board and *SKYD* drive

3.2.2 ENCODER CONNECTION TEM MOTOR WITH CONNECTOR CN2 SKYD

Check documentation enclosed to the motor. The connections between the encoder motor connector and the connector CN2 of the SKYD drive depending on the type of motor encoder used, are the following:

a) Motor *BTS SERIES* with encoder HC20 Hengstler with commutation phases:

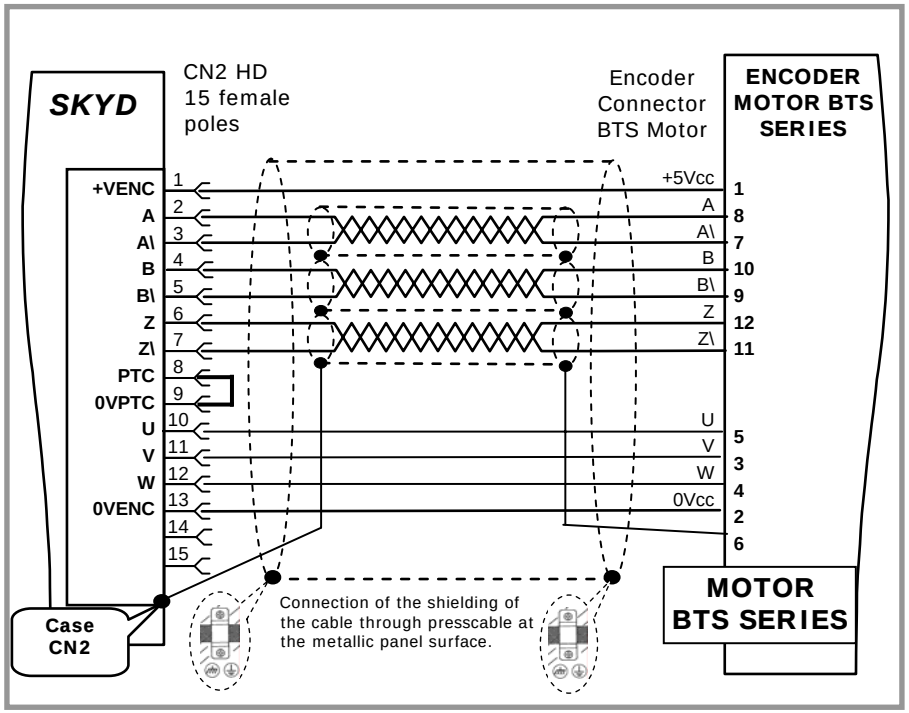


Fig. 3.2.2.1 Connection, encoder HC20 Hengstler with commutation phases, BTS motor and *SKYD* drive

b) Motor *BT SERIES* with encoder TAMAGAWA OIH48 LESS WIRING:

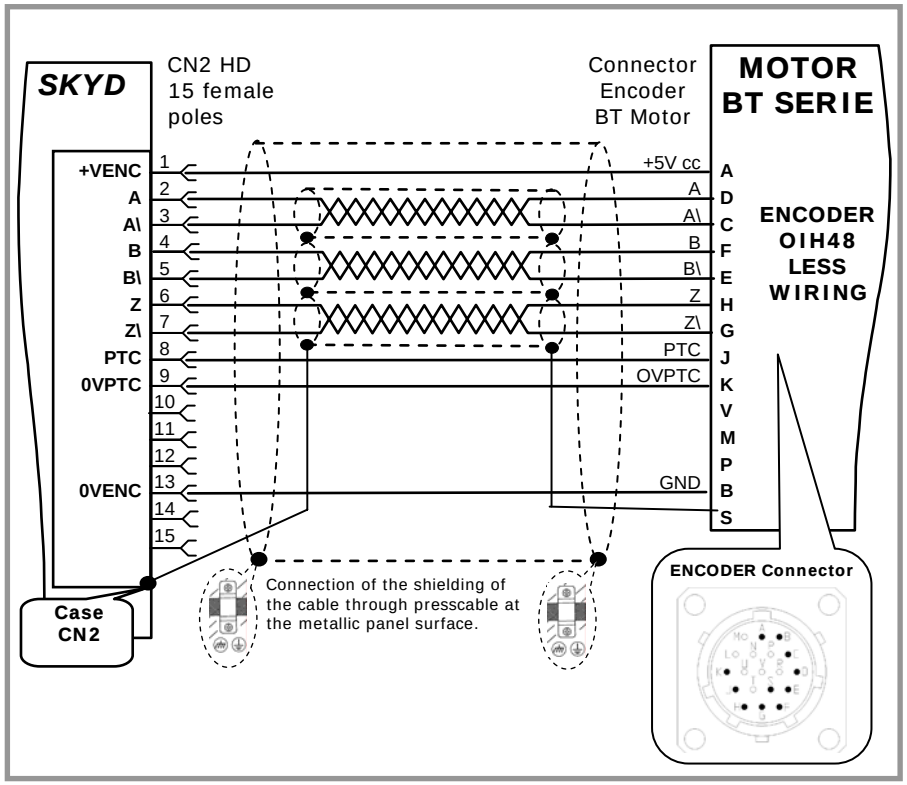


Fig. 3.2.2.2 Connection encoder OIH48 LESS WIRING BT Motor and *SKYD* drive

c) Motor *BT SERIES* with encoder TAMAGAWA OIH48 and HC20 Hengstler, with commutation phases:

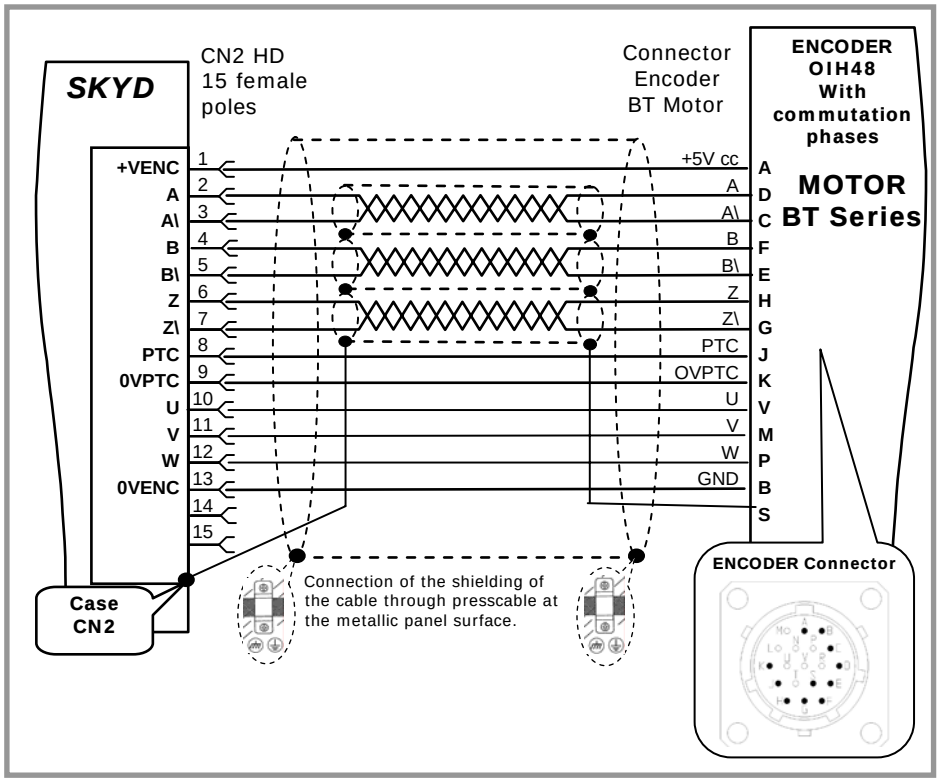


Fig. 3.2.2.3 Connection, encoder OIH48 and HC20 Hengstler with commutation phases, BT motor and *SKYD* drive

3.3 CONNECTIONS OF CONTROL SIGNALS WITH SKYD

To see some examples of connection, refer to application notes, in ***Chapter 6*** of this manual, or at the bottom of the INSTRUCTION MANUAL.

3.3.1 CN3: RS232 SERIAL

For the connection to this connector see: ***setting drive parameters through the serial***. In any case **DO NOT USE A STANDARD SERIAL CABLE**, which could cause hardware failure.

3.3.2 CN1: ENCODER EMULATED

This connector can be used as an encoder output to be used as a input for CN, PLC, etc..
The signals in the connector are given in paragraph 2.2.

3.3.3 CN4: ANALOGICAL AND DIGITAL CONTROL SIGNALS.

In this connector we find the digital signals I/O, the most important are the DIEN: enable digital input of the analogical signal, and the DTEN: enable digital input of the motor power control. In case of control through an analogical signal, a differential input +VREF/-VREF can be used, which is normally used to control the motor speed. For a more detailed description of the CN4 connector signals refer to the INSTRUCTION MANUAL.

4. DRIVE PARAMETERS CHANGE

To adapt the drive functioning to the different applications, you can change some parameters, using the connection to the serial port of a PC and the Motor Control software, downloadable free from www.mdmotion.it.

4.1 DRIVE PARAMETER DESCRIPTION.

SKYD drives are factory configured with default value parameters, valid and safe, for the motor regulator. The motor selection parameter ***MOTOR*** is given with the motor model requested by the client. For most applications, these default settings allow to achieve optimum performance control. In cases where these settings are not sufficient you can change these values. For a detailed description of all parameters and optimisation possibilities of the control characteristics you must refer to the INSTRUCTION MANUAL.

Main Parameters		*Min Value*	*Max Value*	*Default Value*
GPS	Speed-loop proportional gain	0	255	0
GIS	Speed-loop integral gain	0	255	128
Offset	Offset on the speed set-point	0	255	128
Tsc	Torque control in continuous service	0	255	255
Tp	Peak torque control	0	255	255
I2t	Derating factor function	0	12750	0
Set Point	Reference type	0	3	0
Direction	Motor rotation direction	0	1	0
Encoder emulated	Encoder Emulated partition	0	4	0
MOTOR	Motor selection	0	10	-

4.1.1 Motor Table

For a correct setting of the motor parameter selection: "MOTOR", see the motor table which depends from the drive model.

a) SKYD drive *series 230V*:

	Nominal torque (Nm)	Nominal Current (Arms)	Peak Torque (Nm)	Peak Current (Arms)	Constant Torque (Nm/A)	Motor Inertia ($mKgm^2$)	Speed (rpm)	Motor
SKYD23A02	**Review motor table 0**							
		2		**4**				
BTSS	0,75	1,15	2,2	3,45	0,65	0,0175	3000	1
BPSS	1,3	2	2,6	4	0,65	0.0183	3000	2
SKYD23A04	**Review motor table 0**							
		4		**8**				
BTSS	0,75	1,15	2,2	3,45	0,65	0,0175	3000	1
BTSM	1,5	2,65	4,5	7,95	0,57	0.0244	3000	2
BPSS	1,3	2	2,6	4	0,65	0.0183	3000	3
BPSM	2,1	3,7	4,6	8	0,57	0,0255	3000	4
BT2S	2,2	2,9	6,1	8	0,766	0,225	3000	5
BT2M	3	4	6	8	0,74	0,412	3000	6
SKYD23A07	**Review motor table 0**							
		7		**14**				
BPSM	2,1	3,7	5,7	10	0,57	0,0255	3000	1
BT2S	2,2	2,9	8	10.4	0,766	0,225	3000	2
BT2M	4	5,4	10	13,5	0,74	0,412	3000	3
BT2L	5,5	7	11	14	0,78	0,6	3000	4
BT2X	5,7	7	11,4	14	0,81	0,79	3000	5

b) SKYD drive *series 400V*:

	Nominal torque (Nm)	Nominal Current (Arms)	Peak Torque (Nm)	Peak Current (Arms)	Constant Torque (Nm/A)	Motor Inertia ($mKgm^2$)	Speed (rpm)	Motor
	Review motor table 0							
SKYD40A02		**2**		**4**				
BTSS	1,05	1,61	2,63	4	0,655	0,0175	3000	1
BT2S	2,2	1,8	7,4	4	1,23	0,225	3000	2
BPSS	1,3	2	2,6	4	0,65	0.0183	3000	3
	Review motor table 0							
SKYD40A04		**4**		**8**				
BT2S	2,2	1,8	8	6	1,23	0,225	3000	1
BT2M	4	3,5	9,1	8	1,14	0,412	3000	2
BTSS	0,75	1,15	2,2	3,45	0,65	0,0175	3000	3
BTSM	1,5	2,65	4,5	7,95	0,57	0.0244	3000	4
BPSS	1,3	2	3,6	5,50	0,65	0.0183	3000	5
BPSM	2,1	3,7	4,6	8	0,57	0,0255	3000	6
BT2L	5,4	4	10,8	8	1,35	0,6	3000	7
	Review motor table 0							
SKYD40A07		**7**		**14**				
BT2S	2,2	1,8	7,4	6	1,23	0,225	3000	1
BT2M	4	3,5	12	10,5	1,14	0,412	3000	2
BT2L	6	4,5	16,2	12	1,35	0,6	3000	3
BT2X	7,5	5,2	20	13,8	1,45	0,79	3000	4
BPSM	2,1	3,7	5,7	10	0,57	0,0255	3000	5

4.1.2 Emulated encoder divider

This parameter is used to reduce the number of emulated encoder pulse of the CN1 output, which is used as input in the PLC, CNC, ...
Since the number of pulses of the encoder installed on the motor may be excessive, its value can be divided by modifying the parameter "Encoder emulated" according to the table below:

"Encoder emulated"	Pulse partition factor
0	1
1	2
2	4
3	8
4	16

4.2 PARAMETER CHANGE THROUGH SERIAL

Connect the transmission cable from the PC serial interface to the serial interface RS 232 (CN3) of the *SKYD*.
Remove and insert the connection cable only with power supply voltage switched off (drive).

4.2.1 SERIAL CABLE CONNECTION SCHEME

The serial cable connection must contain only the below links, all other pins **must not be connected**.

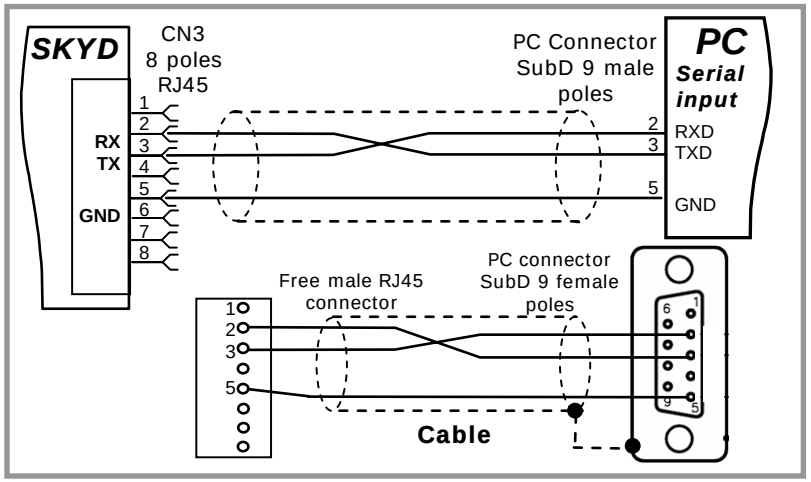


Fig. 4.2.1.1 serial PC and SKYD connection scheme

4.2.1 COMMUNICATION SOFTWARE MOTOR CONTROL

The Motor Control Software allows to set the drive, using the *"Parameter programming"*, to inspect the diagnostic drive with access to the alarm history, using the function *"Alarms"*, and it is very useful in starting up the machine with the display in real time of the variables of major interest for the drive (speed, set-point, torque ...), using the function *"Trace"*. The Motor Control software can be downloaded free from the website www.mdmotion.it

5. DRIVE FUNCTIONAL STATE

5.1 DISPLAY DRIVER FUNCTION STATE.

On the front panel there are three LEDs one GREEN and one RED and one YELLOW which identify the operating status of the *SKYD*.

5.1.1 GREEN LED

The *green Led* indicates the correct supply of the Logic section (24Vdc power supply present).

5.1.2 RED LED

The *red Led* indicates the operating status of the drive:

- **Fixed On:** the drive is not in alarm and the axis is free.
- **High frequency flash:** the drive is not in alarm and the axis is in torque.
- **Low frequency flash:** the drive is in an alarm situation. The number of flashes identifies the alarm code (for the alarm codes, see the chapter "DIAGNOSTICS").

5.2 ALARM CODES

Red led flash	*ALARM*	DESCRIPTION
Nr. 01	OVERVOLTAGE	Tension on the Bus in C.C. above the allowed limit.
Nr. 02	UNDERVOLTAGE	Tension on the Bus in C.C. too low.
Nr. 03	OVERCURRENT	Required current to the drive, too high.
Nr 04	ENCODER FAULT	Alarm of the position sensor.
Nr. 05	HEATSINK OVERTEMP	High heat sink temperature.
Nr. 06	MOTOR OVERTEMP	High motor temperature.
Nr. 07	IGBT FAULT	Excessive current or short circuit on the three phases and ground, over temperature or under voltage in the power stage.
Nr. 15	MOTOR OUT OF CONTROL	Motor out of control

5.3 MALFUNCTION AND SOLUTION

5.3.1 The serial does not communicate with the drive

In the event that the drive does not communicate through the serial verify the following cases:

- check that the cable used has been designed according to the scheme shown in Figure 4.2.1.1, only 3 conductors shall be connected.
- the MC software must be updated to the latest version.
- verify that the COM selected is the one referred by the connection of the PC.
- verify that Motor Control is not in use more times.
- verify that there are other programs that keep busy the serial.

5.3.2 Alarm present on the Drive

- Alarm 01: OVERVOLTAGE:
  - Power supply voltage too high.
  - High inertia load and brake resistor incorrectly sized.
  - Brake resistor damaged or not connected, check the bridge on CN7 for internal brake resistor.
- Alarm 02: UNDERVOLTAGE:
  - Power supply voltage too low.
  - Drive enabled without power supply.
- Alarm 03: OVERCURRENT:
  - Rapid acceleration or deceleration with High inertia load.
  - Verify that the motor connected corresponds to the one selected by MOTOR parameter .
  - Verify the connection of the position sensor CN2.
- Alarm 04: ENCODER FAULT:
  - Verify the connection of the position sensor CN2.
- Alarm 05: HEATSINK OVERTEMP:
  - Drive external temperature, high.
  - Insufficient ventilation.
  - Excessive machine cycle.
- Alarm 07: IGBT FAULT:
  - Check the motor connection and possible short circuit towards ground.
- Alarm 15: MOTOR OUT OF CONTROL:
  - Check motor connection
  - Verify the connection of the position sensor CN2.

6. APPLICATION NOTES

Typical examples of connections between SKYD drive and various controllers.

6.1 CONNECTION BETWEEN SKYD AD A CN

