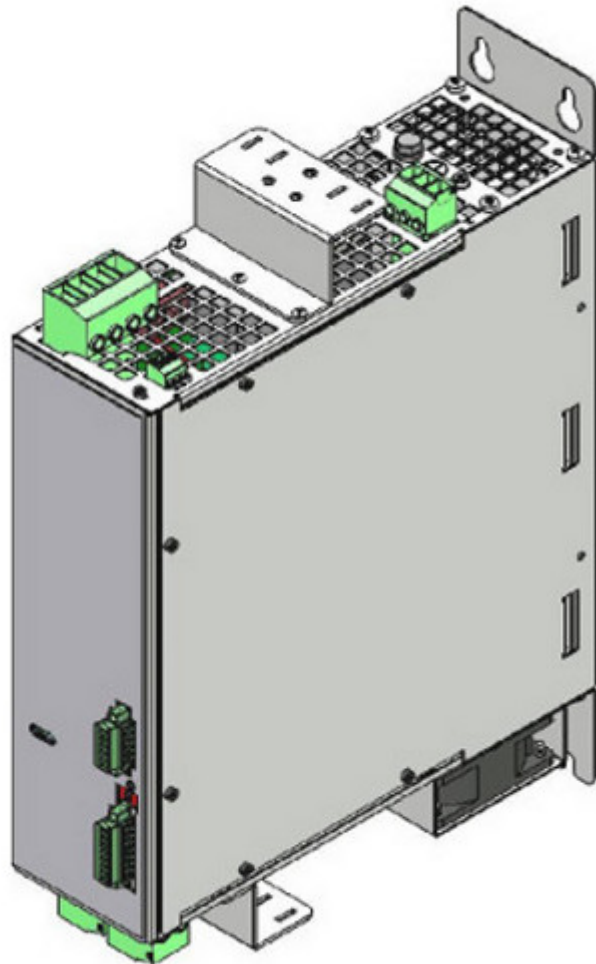


iBMD-DC

Installation manual, use and
maintenance



iBMD-DC

Ed. 1.2 - English - 21/07/2016
(Translated from the original instructions)

IMPORTANT

Bonfiglioli Mechatronic Research Spa reserves the right to make changes to the products described in this document at any time without notice.

This document has been prepared by Bonfiglioli Mechatronic Research Spa solely for use by its customers, guaranteeing that at the date of issue it is the most up-to-date document on the products.

Users use the document under their own responsibility and certain functions described in this document should be used with due caution to avoid danger for personnel and damage to the machines.

No other guarantee is therefore provided by Bonfiglioli Mechatronic Research Spa, in particular for any imperfections, incompleteness or operating difficulties.

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Chapter 1

General informations about this manual

1.1. Aim

This manual is a complete guide to the installation, commissioning, functioning and use of the *iBMD-DC* power supply. There are general purpose informations about the functionalities and about the power supply structure, notices related to the safety for people and for the product; furthermore, for the technicians in-charge to installation, all the data and specifications to be observed for the wiring and the installation are described.

IMPORTANT

What is written in this manual refers to the version of firmware 9 et seq., except from any other different instructions.

Previous firmware versions could not implement all the functionalities described in this manual.

IMPORTANT

What is written in this manual refers to the version of hardware 16 et seq., except from any other different instructions.

Previous hardware versions could not implement all the functionalities described in this manual.

ADVICE

For a better understanding of this manual, it is recommended to have a basic knowledge of Modbus management.

1.2. Recipients

Only specialized staff can modify the iBMD-DC power supplies and use them, who previously read the manual and all the documents related to the product. Specialized staff must have been adequately trained about safety in order to prevent any possible risks. The technical training, foreground and experience of the specialized staff must help them preventing from any possible risk occurring during the product use, from the settings modification to the functioning of the mechanical, electrical and electronic equipment of the device. The specialized staff must know all the current regulations and safe working practices in case of any intervention on the product.

In particular, the following operations must be executed by specialized personnel:

- Transport: for personnel expert in handling sensitive parts of electrostatic charges.
- Unpacking: for qualified electricians.
- Installation: for qualified electricians.
- Use: for qualified staff expert in electro-technology.

The qualified staff must know and follow these rules:

- EN 12100, EN 60364 and EN 60664;
- national safe working practices.

This manual is addressed to all users of the iBMD-DC power supply.

⚠ WARNING

During the power supply functioning beware of danger of death, serious injuries or material damage. For a safe functioning, follow all the safety instructions in this manual. The security officer must check that the staff working with the power supply read and understood this manual before using it.

1.3. Responsibilities

⚠ ATTENTION

Bonfiglioli Mechatronic Research S.p.a can modify the described products in this manual in any time and without any notice.

This manual was written by Bonfiglioli Mechatronic Research S.p.a only for their customers' use providing the most updated version of the products.

The responsibility to use this manual belongs to every user and the use of some functions must be under strict care to avoid any danger for the staff and the equipment.

No other warranty is provided by Bonfiglioli Mechatronic Research S.p.a, in particular for possible imperfections, incompleteness, and/or any other difficulties.

1.4. Abbreviations

Abbreviation	Meaning
0x	Number in hexadecimal notation
HVDC	DC bus voltage, supply voltage of the power section
ac	Alternating current
CE	Communauté Européenne
COM	Serial communication interface for personal computer
CRC	Cyclic redundancy control
dc	Direct current
EEPROM	Electrically erasable programmable memory (permanent memory)
EMC	Electromagnetic compatibility
FW	Firmware
GND	Ground
HW	Hardware
I	Input, generally digital
I ² T	Passing specific over energy
L1, L2, L3	Line charge
LED	Light-emitting diode
LSB	Byte (or bit) less important
MB	Mega Byte
MSB	Byte (or bit) more important
neg	Negative
NC	Not connected
O	Output, generally digital
OSC	Integrated oscilloscope
PC	Personal computer
PE	Protection Earth, protection conductor
pos	Positive
RAM	Random access memory (non permanent memory)
Rbrake	Brake resistor
RBext	External brake resistor
RBint	Internal brake resistor
RTO	Ready To Operate
RX	Reception
s.l.m.	Above sea level
SW	Software
Temp	Temperature
TX	Transmission

1.5. Symbols




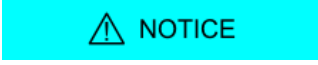



Symbol	Description
	It shows a surely dangerous situation, in case of failure to comply with safety rules it can lead to a serious or fatal accident
	It shows a probably dangerous situation, in case of failure to comply with safety rules it can lead to a serious or fatal accident or damage to the equipment.
	It shows a probably dangerous situation, in case of failure to comply with safety rules it can lead to a serious accident or damage to the equipment.
	It shows a potentially dangerous situation, in case of failure to comply with safety rules it can lead to a serious accident or damage to the equipment.
	It shows the presence of dangerous voltages that can cause electric shocks.
	It shows the problems related to electromagnetic compatibility.
	It shows the presence of surfaces and/or heat sources that can cause burns.

Table 1.1. Danger classes



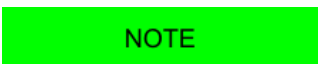
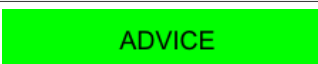
Symbol	Description
	It shows some information to pay attention to. Please pay attention to what has been shown.
	It shows some important information on the mentioned topic.
	It shows some important information on the text about the mentioned topic.
	It shows some useful information on the mentioned topic.

Table 1.2. Information classification

1.6. Definitions

Modbus is a registered trade mark of Schneider Automation Inc.

WINDOWS is a registered trade mark of Microsoft Corporation.

POWER SUPPLY

The name POWER SUPPLY used in this manual has to be intended as an AC/DC rectifier not isolated.

BDM Base drive module

Activation module made up by a conversion section and a section used to check the speed, the torque, the power or the voltage, etc.

CDM Complete drive module

Activation without motor and sensors mechanically coupled to the drive shaft, made up by a BDM, but not limited to it, and other devices, such as the charge section and the auxiliaries. The *iBMD-DC* is defined as part of a CDM, with BDM excluded, so a power supply with power section and auxiliaries.

Node (Modbus)

Hardware device (drive, sensors, actuators) connected to the communication bus which can communicate with the other devices.

Network protocol

All rules, mechanisms and formalities that two or more electronic devices connected one another must respect to start a communication.

Modbus register

Memory area of 1 Word = 16 bit = 2 byte that contains a numeric value, accessible both in reading and in writing. It's identified by a number that represents its memory position and it's used to exchange data in the Modbus protocol.

Transition

Intermediate phase that allows the transition between the system logical states (see [Chapter 8, Power supply logical states](#)).

1.7. Reviews

Revision History		
Revision 1.2	21/07/2016	Author: Bonfiglioli Mechatronic Research S.p.a
• First revision of the manual.		

Chapter 2

Informations about the *i*BMD-DC power supply

2.1. Regulations



The *i*BMD-DC power supply respects the following regulations:

- 2004/108/CE relating to electromagnetic compatibility;
- 2006/95/CE relating to electrical equipment designed for use within certain voltage limits;

in conditions in which the installation may be considered as typical (then the instructions in the user manual are respected and there are not particular work environment or installation needs).

Bonfiglioli Mechatronic Research S.p.a guarantees the conformity of the power supply to the following harmonized standards:

EN 61800-5-1:2009	Adjustable speed electrical power drive systems Part 5-1: Safety requirements - Electrical, thermal and energy
EN 61800-3:2004 EN 61800-3/A1:2013	Adjustable speed electrical power drive systems Part 3 : EMC Requirements and specific test methods
EN 61000-6-2:2005	Electromagnetic Compatibility (EMC) Part 6-2: Generic Standards - Immunity for industrial environments
EN 55011:2009 EN 55011/A1:2010	Limits and methods of measurement of radio disturbance characteristics of industrial, scientific and medical (ISM) radio frequency equipment

The iBMD-DC power supplies are commercialized as components of a Power Drive System, belong to the restricted distribution category and are intended to the installation in industrial environment.

The installation of these devices is intended to specialized personnel that has an in-depth knowledge about the safety requirements and the electromagnetic compatibility (EMC).

The planner has the responsibility to guarantee that the product or the final system comply to the pertinent regulations that are in force in the country in which the product (or the entire system) is used.

If the entire system is connected to a low voltage distribution public network it will be necessary to pay attention to the network harmonic and flicker inclusion effects to guarantee the overall certification.

 **WARNING**

The device builder using the iBMD-DC power supplies must analyse the risk for the device and implement the necessary measures to safeguard the device itself and the surrounding people from any unforeseen motions.

2.2. General features of the iBMD-DC

This power supply cannot be commercialized as single unit but must be part of a permanent installation or implant. In particular, the iBMD-DC power supply is made by a power module, a control section, internal brake resistor.

The power supply must be contained in a casing so that to guarantee the pollution degree 2. All the version of this power supply provide digital I/O, leds and dip switches. There is also a permanent memory and a debug serial port in which the protocol Modbus has been implemented.

NOTE

For further details on the features and options of the available versions, see [Chapter 6, Technical features](#) and [Chapter 14, Order codes](#).

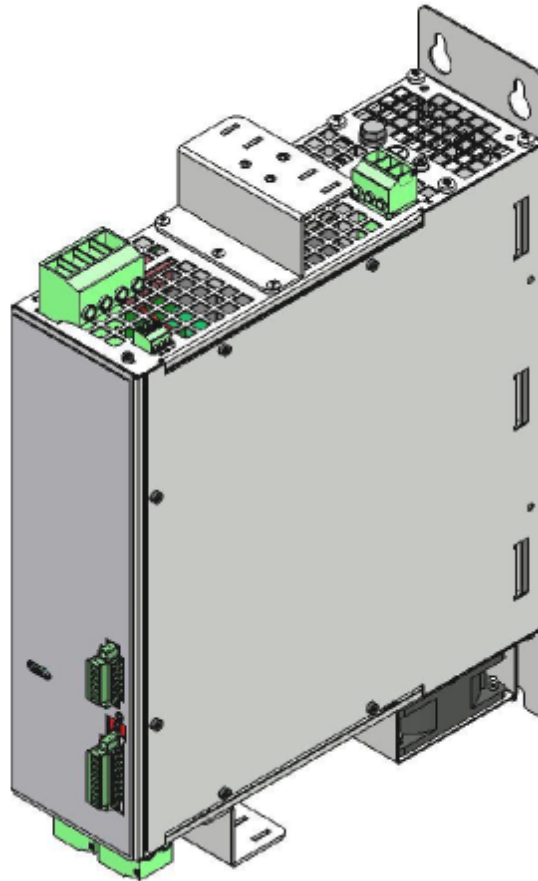


Figure 2.1. The *iBMD-DC* power supply.

Features	<i>iBMD-DC</i>
Dimensions	See Section 6.1, “Dimensions and sizes”
Range of supply of the power section	See Table 6.1 and Table 6.2
RBrake (Brake resistor)	Internal with possibility of adding an external one, see Section 7.2.5, “Brake resistor”
Range of supply of the control section	See Table 6.3
Debug communication port	Modbus on RS232
Leds	Information and local diagnostics (see Section 7.3, “Leds”)
Number of digital inputs	1 (See Section 6.8, “Digital inputs and outputs”)
Number of digital outputs	3 (See Section 6.8, “Digital inputs and outputs”)
RTO contact (Ready To Operate)	1 (See Section 6.7, “RTO contact: Ready To Operate”)

Table 2.1. General features of the *iBMD-DC*.

The software on the *iBMD-DC* power supply is divided in two typology:

- *Boot firmware*: it boots the power supply by enabling some basic services and, after an initial phase of identification and diagnostics of the system, it runs the firmware
- *Firmware*: it manages all the power supply operating functions

2.3. System Block Diagram

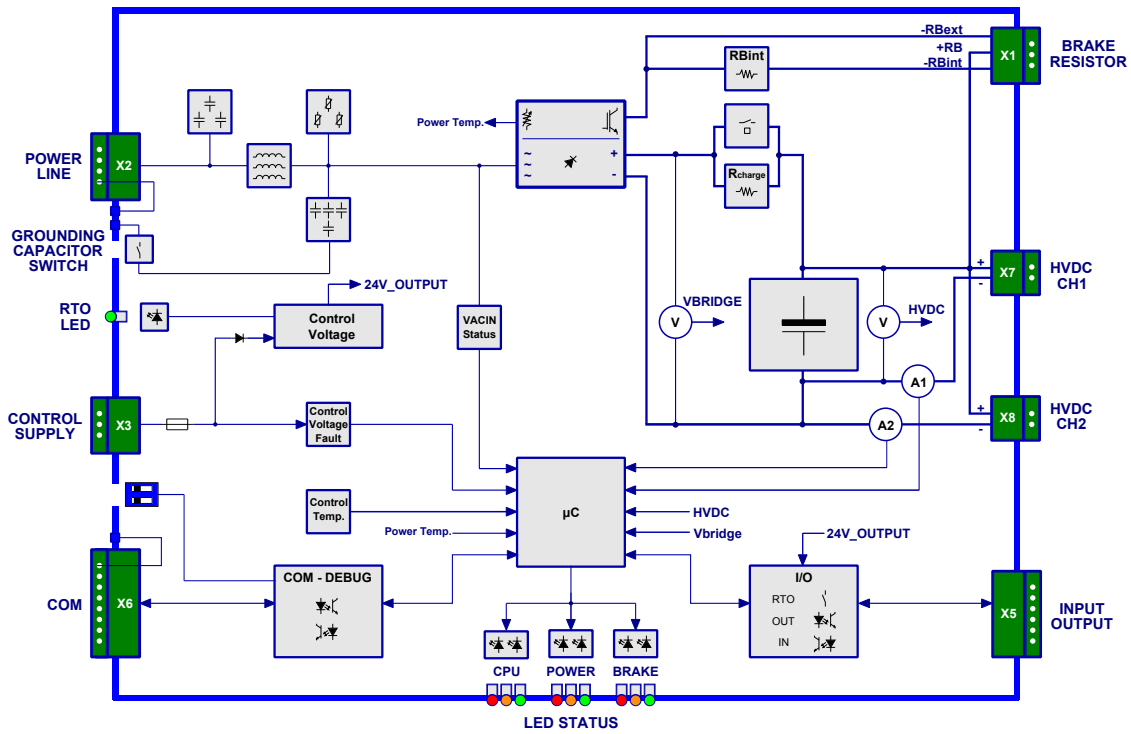


Figure 2.2. System Block Diagram

2.4. iBMD-DC use

The iBMD-DC are power supplies for drives that need exclusively a DC source (refer to Chapter 6, *Technical features* to check the compatibility).

2.5. Packaging

The package includes:

- The iBMD-DC power supply
- The X1, X2, X3, X5, X6, X7, X8 connectors
- illustrative sheet

NOTE

No cable is provided in the standard equipment.

For eventual accessories contact the Bonfiglioli sales office.

Before to begin to work with the power supply, verify that there are not visible damages. Be sure that the iBMD-DC power supply you have taken from the package is the correct

model for your application, that it corresponds to what you have ordered and that you can provide a voltage supply as prescribed for the system.

2.6. Methods of product disposal at the end of life

The device must be disposed as electrical or electronic waste. At the end of their life, the *i*BMD-DC power supplies can be easily disassembled and their main component can be separated in order to facilitate an efficient recycling. Many parts of this device are fixed through normal screws. The packaging of the product is of good quality and can be re-used For the recycling or the disposal of a product or of a packaging, the Bonfiglioli calls to respect the current regulations and the more appropriate procedures.

2.7. Identificative plate

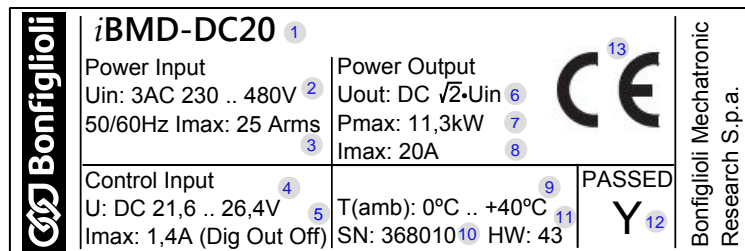


Figure 2.3. Product plate example.

reference	Meaning
1	Product name
2	Input voltage range of the power section
3	Maximum input current of the power section
4	Voltage range of the control section
5	Maximum current of the control section
6	Output voltage range of the power section
7	Maximum output power of the power section
8	Maximum output current of the power section
9	Environment temperature for the correct functioning, according to the technical data
10	Serial number
11	Hardware revision
12	Conformities test results and sign of the operator that has executed the test
13	CE mark

Table 2.2. Plate fields

2.8. Safety precautions and limits



The precautions described in this paragraph are perfect to avoid any dangerous situation by suggesting the right use of the product. Only qualified staff who read and understood all the documents on this product can use it. The specialized staff must follow a safety training in order to avoid any risks related to the product use (included any changes in the parameters) and to find a possible remedy.

 DANGER

The power supply must not be used in an explosive or corrosive environment, in the presence of inflammables, water or fuels. There can be risk of fire, electric shock or injuries.

In case of failures because of accidental circumstances or wiring errors the power section can even provoke electric arcs. The power supply must be installed in an environment without any inflammables. It is particularly forbidden to use it in the presence of inflammable gases or vapours.



 DANGER

Do not transport, install or make any connections or inspections and don't touch the output connectors when the drive is charged. In such cases always switch the power off and wait at least 10 minutes and be sure that the residual voltage on the power connectors are not so high to cause an electric shock. Check with a multimeter that the voltage between +HVDC and -HVDC has decreased under 50Vdc.



 DANGER

The usage of this product implies the presence of a voltage greater than 50V, therefore there is life-threatening and a risk of electric shock and serious injury. Follow the general and safety regulations when you are working on the power related installations.

The power supply must be installed in a cabinet or protective container that satisfies the regulations related to the specific application, so that the parts with an applied voltage are not accessible.

 WARNING

Keep the power supply within the specified ranges in order to avoid any risks of fire, electric shocks and damaging the power supply. In the same way connect the cables in a safe way by respecting the connections.



 DANGER

Do not touch the power supply during functioning or immediately after its disabling: the surface temperature can be higher than 80°C.

To prevent any risks of damaging the power do not obstruct or limit its ventilation. Keep any metal objects away from the ventilation apertures of the power supply.

 WARNING

Do not open and do not modify the power supply: for any internal checks please contact Bonfiglioli Mechatronic Research S.p.a. In case of forcing the power supply the warranty expires.

 **ATTENTION**


Please do not short-circuit any signals from the power connector with the drive case or logic signals.

It's recommended a control supply wiring separated by the power supply one to avoid malfunctioning and to limit the control logic signals noises.

 **WARNING**

The cables section for the power stage must be adequate to the power supply power.

Always connect the protection ground (grounding screw, see [Grounding screw connection](#)) and the functional earth (pin 4 of the [X2 Power Line connector](#)) with two separate cables (star connection of the grounds).

 **NOTICE**

When some fault is found, the power supply automatically disables and a led signal shows the possible cause.

 **WARNING**

The magnetic and electromagnetic fields, that are generated by the conductors in which the current flows or by permanent magnets inside the electric motors, represent a serious danger for the people with the pacemaker, metallic prostheses and hearing aids. Be sure that these people have no access to the areas in which these systems are presents (both during functioning and in storage). Eventually, if these persons have to enter in the described areas, consult a doctor.

 **DANGER**

This product is intended to be exclusively used in machines and systems in industrial environment, respecting the described application, environmental and functioning conditions.

Follow the safety regulations and the ordinances of the country in which the product (or the relative control and command system) is used.

It is recommended not to use the product for any further purpose than those specified in this manual.

Chapter 3

General information about MotionDrive

MotionDrive is a programme for *personal computer* used to control, configure and programme in a simple, quick and perceptive way the *iBMD-DC* power supply.

From the tab Main of MotionDrive it is possible to know the whole power supply status. For example: the detailed description of the found errors, the status of the outputs and the digital inputs, operative status, connection status, etc...

IMPORTANT

What is written in this manual refers to the MotionDrive 3.0.1.223 version et seq..
Previous versions of MotionDrive may not implement all the functionalities described here.

3.1. Requirements and compatibility

Minimum PC requirements:

- System with compatible processor Pentium 133 MHz or higher.
- Sufficient memory for the operating system, minimum 128 MB, recommended 512.
- Hard disk with minimum available space to install the programme, at least 35MB.
- Display adapter and monitor Super VGA, minimum resolution 800 x 600 px, better 1024x768 px or higher.

Compatibility with the following operating systems:

- Microsoft Windows XP
- Microsoft Windows Vista, 7, 8 or latest versions, 32bit and 64bit.

3.2. Installation

Check if all the system prerequisites are respected ([Section 3.1, Requirements and compatibility](#)).

Installation from the Bonfiglioli website

- Connect to the <http://www.bonfiglioli.com> website and enter the *Products & Solutions*. Here it's possible to select the page dedicated to the *iBMD-DC* through the *Product name* drop-down menu. In the product page it's possible to download the *MotionDrive.msi* file in the *Download files* area.
- Run the downloaded file by following the proposed procedure.
- Every MotionDrive version is released with the firmware pack that's most updated in relation to the release date.

Installation from file

- If the *MotionDrive.msi* file is already present in the PC, run the file and follow the proposed procedure.
- Every MotionDrive version is released with the firmware pack that's most updated in relation to the release date.

ADVICE

Please accept all the configurations proposed during the installation.

3.3. Update

To update MotionDrive you only need to install the updated version of the programme by choosing one of the procedures proposed in [Section 3.2, Installation](#).

3.4. MotionDrive overview

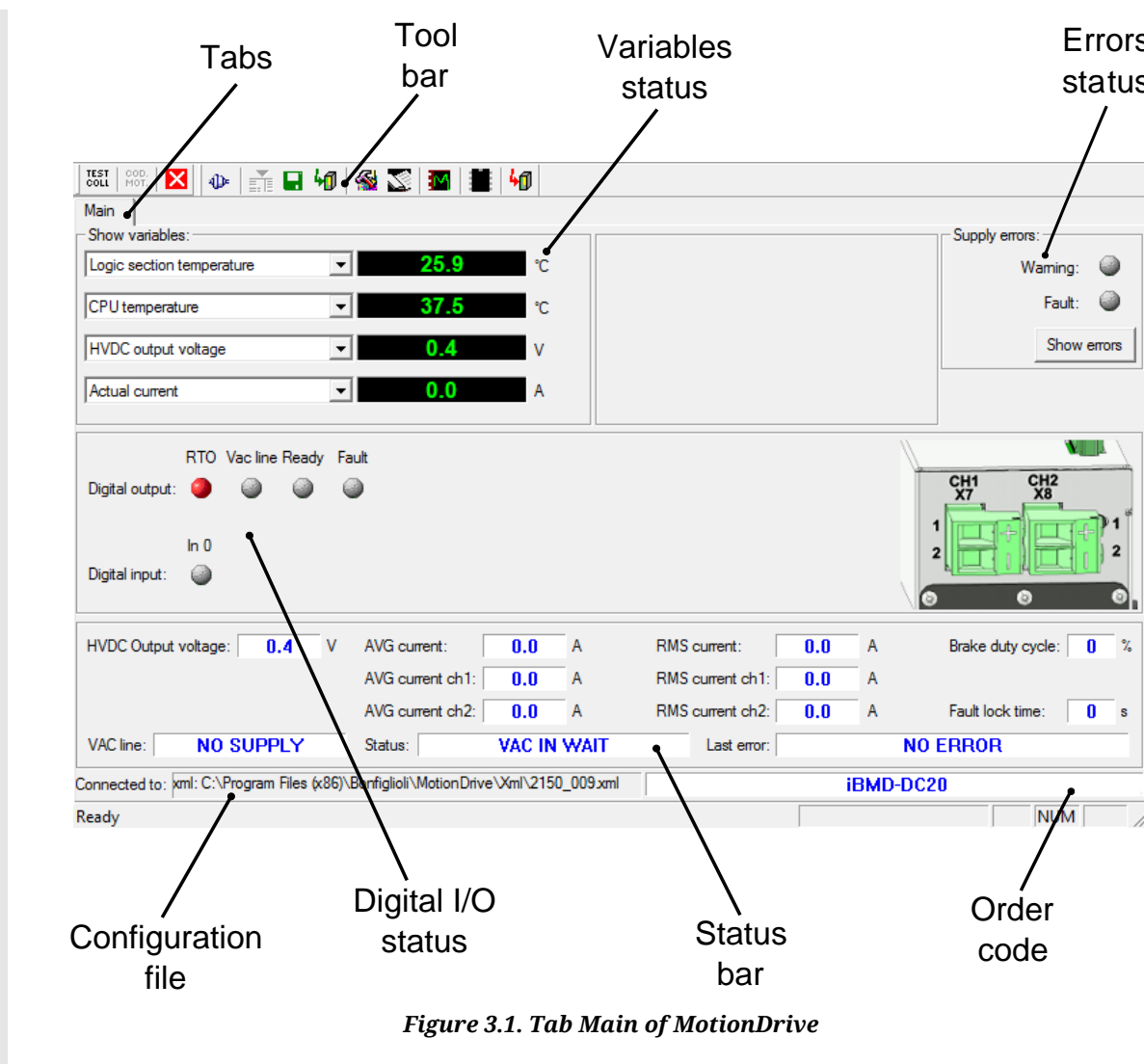


Figure 3.1. Tab Main of MotionDrive

Tab Main	
Functionalities	Link
Variables status	Monitoring in real time of the most interesting variables
Errors status	Chapter 10, Fault and warning
Configuration File	Chapter 11, Software updating
Digital I/O status	Section 6.8, Digital inputs and outputs
OrderCode	Section 14.1, OrderCode

Table 3.1. Functionalities of the Tab Main

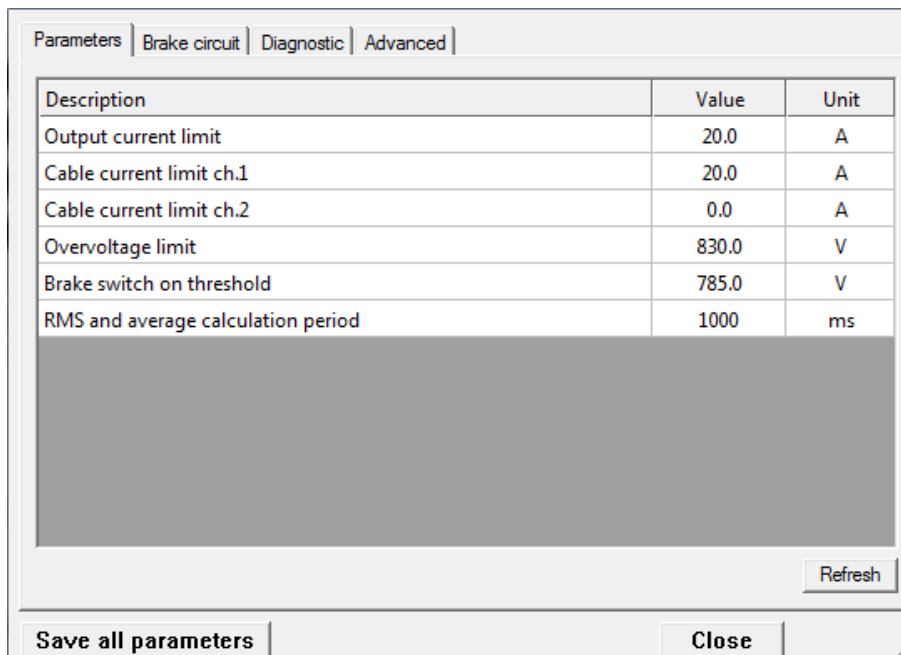
3.5. Show errors

This is the visualization page of the faults and warnings that are detected by the power supply in relation to the list described in [Table 10.1](#). The informations are divided in two groups (warning and fault), each group report the anomaly in dynamic and retentive way, to reset the retentive data the Reset errors button is provided. For further details on this argument see [Chapter 10, Fault and warning](#).

3.6. Supply Setup

The Supply Setup window allows to immediate access to the main configuration parameters of the power supply (for the details of these parameters refer to [Chapter 9, iBMD-DC parametrization](#)).

3.6.1. Supply Setup - Parameters



Description	Value	Unit
Output current limit	20.0	A
Cable current limit ch.1	20.0	A
Cable current limit ch.2	0.0	A
Overvoltage limit	830.0	V
Brake switch on threshold	785.0	V
RMS and average calculation period	1000	ms

Figure 3.2. Tab Parameters of Supply Setup

The parameters contained in this page can be modified by the user. By clicking on the numeric value the inserted data can be modified; when the new value is confirmed (ENTER button) the WRITE and CANCEL buttons became active; by clicking WRITE the data is written in a non retentive mode, so if the power supply is turned off and on again, the previous values are restored.

To save in retentive mode the new parameters set, after the WRITE button has been clicked it's even necessary to click the SAVE ALL PARAMETERS button.

Access with MotionDrive:

Main menu > Supply > Supply setup ... > Parameters

Toolbar >  > Parameters

The parameters that can be set are:

- [OutputCurrentLimit](#)
- [CableCurrentLimit\(CH1\)](#)
- [CableCurrentLimit\(CH2\)](#)
- [OvervoltageLimit](#)
- [BrakingCircuitActivationVoltage](#)
- [RMS_Average_CalculationPeriod](#)

3.6.2. Supply Setup - Brake Circuit

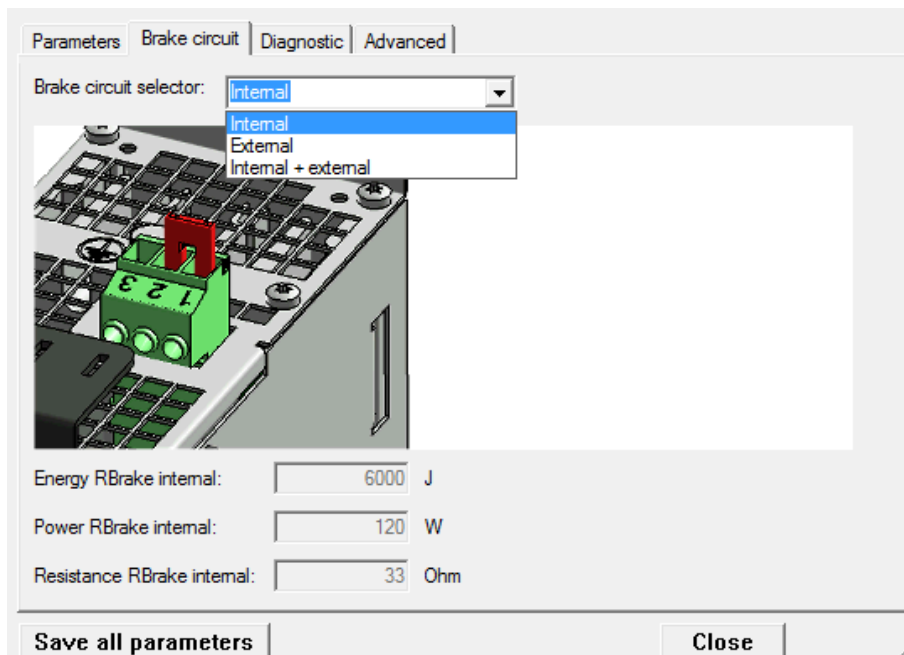


Figure 3.3. Tab Brake Circuit of Supply Setup

This is a configuration page of the brake resistor. Through the drop-down menu on the top (that directly works on the [BrakeCircuitSelector](#) parameter value) it's possible to select the brake circuit type, that can be connected to an internal or external (or both) resistor. The external resistor, if different than the default type, can be configured by setting the resistor power and energy values of the desired model. If the external resistor use is enabled, the resistance, power and energy values becomes writable and, by clicking on the numeric value, the inserted data can be modified; when the new value is confirmed (ENTER button) the WRITE and CANCEL buttons became active; by clicking WRITE the data is written in a non retentive mode, so if the power supply is turned off and on again, the previous values are restored.

To save in retentive mode the new parameters set, after the WRITE button has been clicked it's even necessary to click the SAVE ALL PARAMETERS button.

Access with MotionDrive:

Main menu > Supply > Supply setup ... > Brake Circuit

Toolbar >  > Brake Circuit

The read only parameters (related to the internal resistor) are:

- [IntBrakeResistorNominalEnergy](#)
- [IntBrakeResistorNominalPower](#)
- [IntBrakeResistorValue](#)

The parameters that can be set (related to the external resistor) are:

- [ExtBrakeResistorNominalEnergy](#)
- [ExtBrakeResistorNominalPower](#)

- [ExtBrakeResistorValue](#)

3.6.3. Supply Setup - Diagnostic

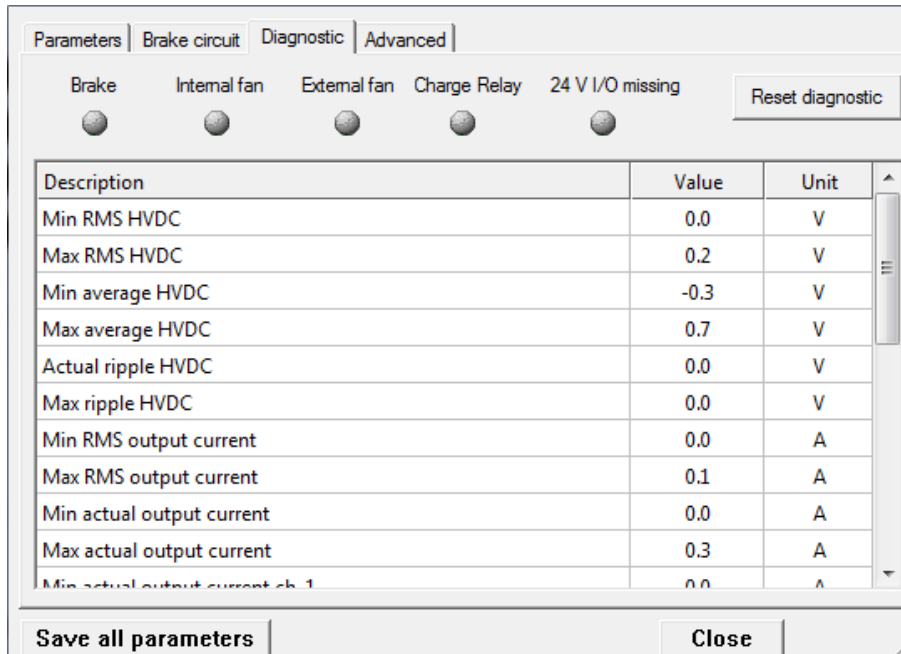


Figure 3.4. Tab Diagnostic of Supply Setup

This is a diagnostic informations page about the power supply. There are not settable parameters, the only allowed operation is the activation of the Reset Diagnostic button that resets the retentive variables of the minimum and maximum visualized values (for example [MinHVDC_OutputVoltage](#) and [MaxHVDC_OutputVoltage](#)).

Access with MotionDrive:

Main menu > Supply > Supply setup ... > Diagnostic

Toolbar >  > Diagnostic

The visualized parameters that can be only read are:

- [MinHVDC_OutputVoltage](#)
- [MaxHVDC_OutputVoltage](#)
- [MinRMS_Current](#)
- [MaxRMS_Current](#)
- [MinActualCurrent](#)
- [MaxActualCurrent](#)
- [MinActualCurrentCH1](#)
- [MaxActualCurrentCH1](#)
- [MinActualCurrentCH2](#)
- [MaxActualCurrentCH2](#)
- [MaxActualDeviceEnergyOverload](#)
- [MaxDeviceEnergyOverloadPercentage](#)

- [MaxBrakeEnergy](#)
- [MaxChargeCircuitEnergy](#)
- [MaxAveragePower](#)
- [BackfeedEnergy](#)
- [MaxBackfeedEnergy](#)
- [MinControlSectionTemperature](#)
- [MaxControlSectionTemperature](#)
- [MinPowerSectionTemperature](#)
- [MaxPowerSectionTemperature](#)

3.6.4. Supply Setup - Bonfiglioli Advanced

Description	Value	Unit
Model (1=20 Amp. supply, 2=40 Amp. supply)	1	
Automatic restart function (0=disabled, 1=enabled)	0	
Min HVDC	100.0	V
Max HVDC	830.0	V
Brake resistor value	33	Ohm
Brake resistor nominal energy	6000	J
Brake resistor nominal power	120	W
Capacitor discharge timeout	4000	ms
Control side temperature fault	85.0	°C
Control side temperature warning	70.0	°C
Power side temperature fault	90.0	°C
Power side temperature warning	80.0	°C

Figure 3.5. Advanced tab of Supply Setup

This is a page that show some default settings and cannot be modified.

Access with MotionDrive:

Main menu > Supply > Supply setup ... > Advanced

Toolbar >  > Advanced

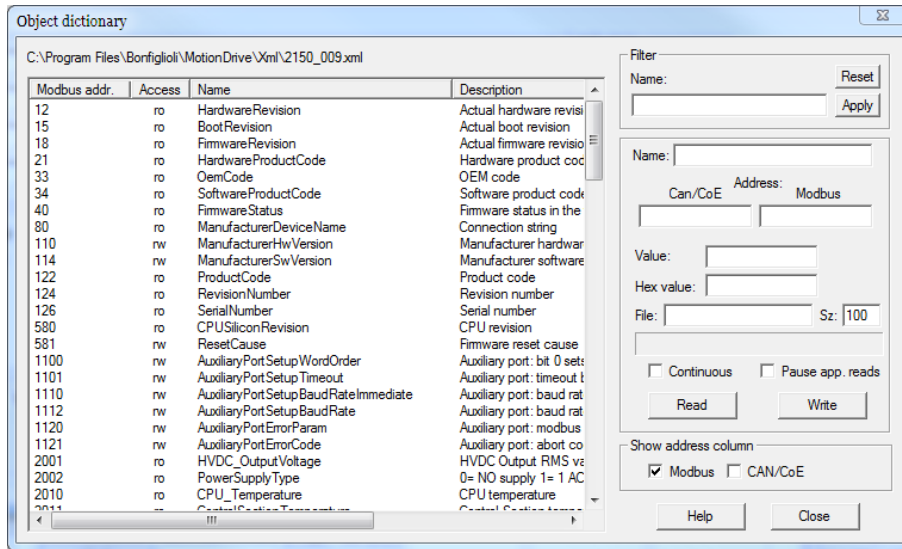
3.7. Object dictionary

In this page it's possible to access to all the implemented parameters (power supply dictionary), through Modbus protocol. Some parameter can only be read. The dictionary, divided in parameters groups, is described in [Chapter 12, Object dictionary](#)

Access with MotionDrive:

Main menu > Supply > Object dictionary ...

Toolbar > 



To select the parameter to be read or written in the Object dictionary window, you can click on the proposed list, write the name and the address or use the search by name functions in the box Filter.

ADVICE

To interpret any error messages please see [Section 10.4, Errors in parameters reading / writing](#).

Besides a series of internal parameters, even some configuration and diagnostic parameters are present. Some of them can only be read, some others can even be written. The following tables list the most useful parameters between the provided ones.

MONITOR AND DIAGNOSTIC PARAMETERS (read only)	
Modbus address	Parameter link
12	HardwareRevision
15	BootRevision
18	FirmwareRevision
126	SerialNumber
2001	HVDC_OutputVoltage
2002	PowerSupplyType
2010	CPU_Temperature
2011	ControlSectionTemperature
2012	PowerSectionTemperature
2013	ActualCurrent
2014	ActualCurrentLimit
2024	DeviceStatus
2025	LastFaultCause
2030	DeviceEnergyOverloadPercentage
2031	BrakeEnergyOverloadPercentage
2032	ChargeCircuitEnergyOverloadPercentage

MONITOR AND DIAGNOSTIC PARAMETERS (read only)	
Modbus address	Parameter link
2048	RMS_Current
2052	RMS_OutputCurrent
2054	RMS_BackfeedingCurrent
2056	AveragePower
2058	BackfeedEnergy
2060	ControlSideFaultTemperature
2061	ControlSideWarningTemperature
2064	PowerSideFaultTemperature
2065	PowerSideWarningTemperature
2068	FaultLockTime
2400	RetentiveWarning
2402	DynamicWarning
2404	RetentiveFault
2406	DynamicFault

CONFIGURATION PARAMETERS (read only)	
Modbus address	Parameter link
2100	DeviceModel
2101	AutomaticRestartFunction
2102	MinVoutFaultThreshold
2103	MaxVoutFaultThreshold
2107	IntBrakeResistorValue
2108	IntBrakeResistorNominalEnergy
2110	IntBrakeResistorNominalPower
2114	CapacitorDischargeTimeout

CONFIGURATION PARAMETERS (settable by the user)	
Modbus address	Parameter link
2112	RMS_Average_CalculationPeriod
2134	OutputCurrentLimit
2135	OvervoltageLimit
2136	BrakingCircuitActivationVoltage
2137	BrakeCircuitSelector
2138	ExtBrakeResistorNominalEnergy
2140	ExtBrakeResistorNominalPower
2141	ExtBrakeResistorValue
2142	CableCurrentLimit(CH1)
2145	CableCurrentLimit(CH2)

Chapter 4

Communicating with MotionDrive

The power supplies of the *iBMD-DC* series provide a debug communication port where the protocol Modbus is implemented. Through the connector **X6 COM port** it's possible to connect to the port, which purpose is the configuration and the commissioning of the power supply through MotionDrive (see [Chapter 3, General information about MotionDrive](#)).

NOTE

The Modbus protocol that's implemented in the power suppliers respects the regulations of the **Modbus organization**: in this section are only reported the implemented functionalities indications.

In the protocol only the transmission mode of RTU type has been implemented.

Modbus frame

the Modbus protocol uses a frame that's made of some fields, in [Figure 4.1](#) their scheme is indicated.

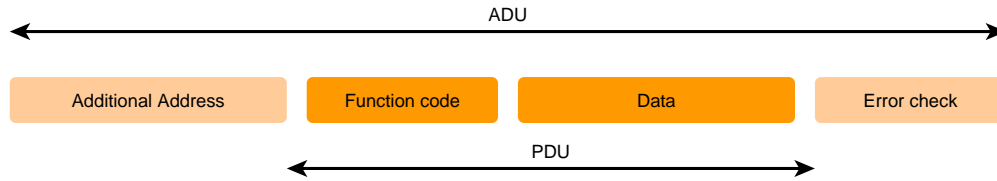


Figure 4.1. Modbus frame

the *Function code* field shows which operation the power supply must run, once received and checked the whole frame, while checking it's not damaged. This information occupies 1 byte and has a range of valid values from 1 to 127; the codes between 128 and 255 are used for the **Exceptions** but the value 0 is not accepted. In [Table 4.1](#) you can find all the accepted codes.

Funct. Code	Name	Description
3	Read Holding Register	Reading one or more parameters (at 16/32 bits) starting from the Modbus address shown in the frame (such as <i>Read Input Register</i>).
4	Read Input Register	Reading one or more parameters (at 16/32 bits) starting from the Modbus address shown in the frame (such as <i>Read Holding Register</i>).
6	Write Single Register	Writing a parameter at 16 bits near the Modbus address shown in the frame. If the Modbus address refers to a parameter greater than 16 bits, the operation is not run and the power supply returns an exception.
7	Diagnostics	The diagnostics is only simulated and it has been implemented only to be compatible with the terminals requesting it.
16	Write Multiple Register	Writing one or more parameters (at 16/32 bits) starting from the Modbus address shown in the frame.

Table 4.1. Function Codes supported by the power suppliers.

The *Function codes* (3, 4, 6 and 16), described in the previous chart, give full access to all power supply parameters through the object dictionary in [Chapter 12, Object dictionary](#).

Exceptions

If the power supply receives a message without communication errors, but it cannot run the requested operation or there is an error in the protocol, the power supply answers to the request with an exception frame. In [Table 4.2](#) you can find the implemented exception codes.

Funct. Code	Name	Description
1	Illegal function	Function code not supported.
2	Illegal data address	Modbus address not accepted. More precisely, the combination of the Modbus address and of the number of data to write / read is not valid (all addresses included in the requested range must be in the vocabulary).
3	Illegal data value	Data quantity not accepted (too high or equal to 0).
4	Slave device failure	Error in the running of the requested action.

Table 4.2. Exception codes implemented in the power supply.

4.1. MotionDrive via RS232 (debug communication port)

Connect the PC serial port to **X6 COM port**. For further information see [Section 7.2, Electrical connections](#).

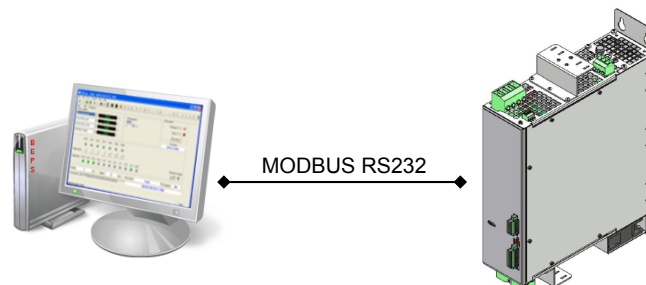
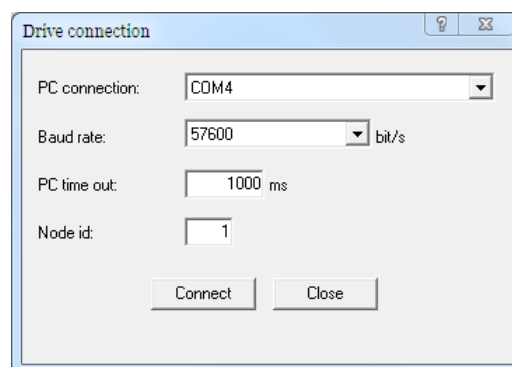


Figure 4.2. Point-point communication scheme with MotionDrive.

Start MotionDrive from: **Start menu > Programs > Bonfiglioli > MotionDrive**.
Set the connection parameters in the window *Supply connection*.



If the programme has already been started, run a new connection. Access:

Main menu > File > New connection ...

Toolbar > 

Connection parameters

1. *PC connection*: choosing the connection physical port (COM1, COM2...)
2. *Baud rate*: choosing the communication speed (the power supply default value is 57600bit/s).
3. *PC time out*: if the power supply does not answer during a longer time period than this value, the communication is interrupted and it is necessary to reconnect (the default value is 500 ms).
4. *Node id*: set the value 1.

ADVICE

In case of more connection interruptions it may be necessary to increase the PC time out. It is advisable not to increase the timeout more than 5 seconds.

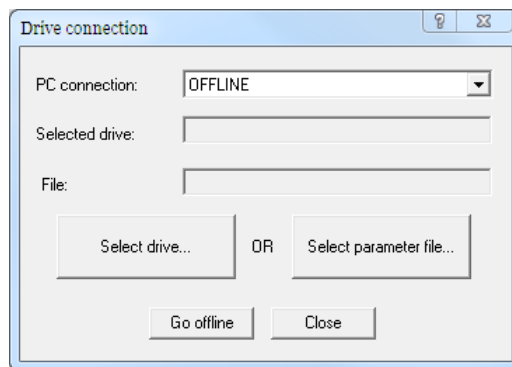
4.2. Offline mode

Through the Offline mode it is possible to connect to a virtual power supply through MotionDrive. To enable this mode, start MotionDrive or request a new connection by pressing



In the window *Supply connection*:

1. Choose *OFFLINE* in the pull-down menu *PC connection*
2. Select the power supply type by pressing **Select drive...** or a parameters file previously saved by pressing **Select parameter file...**
3. Start the Offline mode by pressing **Go offline**.



NOTE

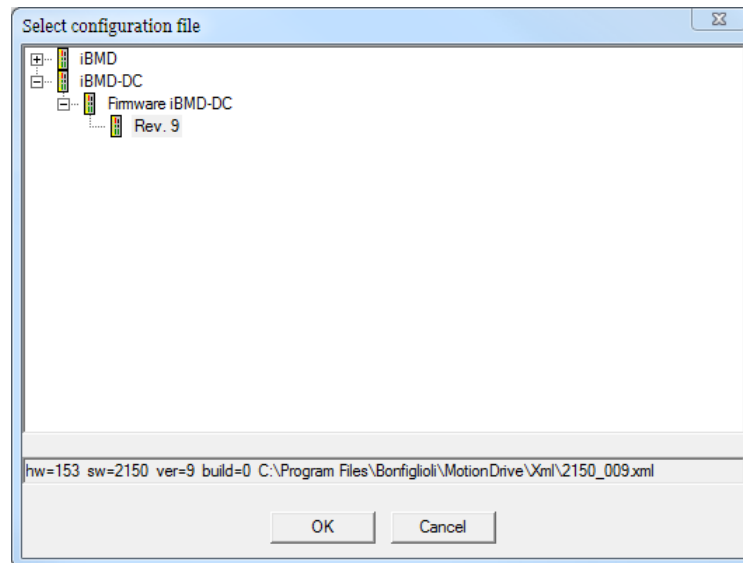
The Offline mode is the best way to debug the system remotely by analysing the parameters file containing the problem.

How to select the power supply

Choose in the window *Select configuration file* the firmware Configuration file and the related version you are going to work with by exploring the stem-and-leaf diagram.

ADVICE

Always choose the latest available firmware version. After having selected the file, check that the power supply data shown in the field below are the wanted ones.



What cannot be done in the Offline mode

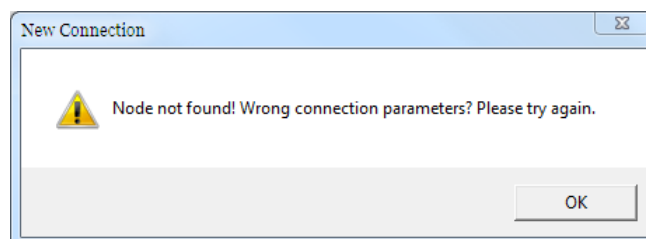
In the Offline mode you can run all the operations foreseen by MotionDrive, except from:

- Tab Main
 - download the firmware
 - download a parameters file ()
 - monitor of the variables in this page
- Supply setup
 - Diagnostic functionality
- Oscilloscope
 - enabling a data capture

4.3. Communication errors with MotionDrive

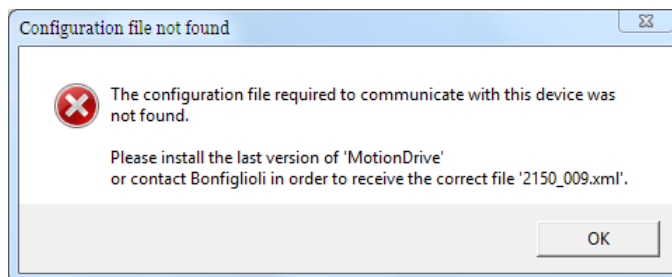
New connection

If during the connection the following window appears check carefully the electrical connections, the correctness of the [Connection parameters](#) and if the power supply is correctly supplied; then try again.



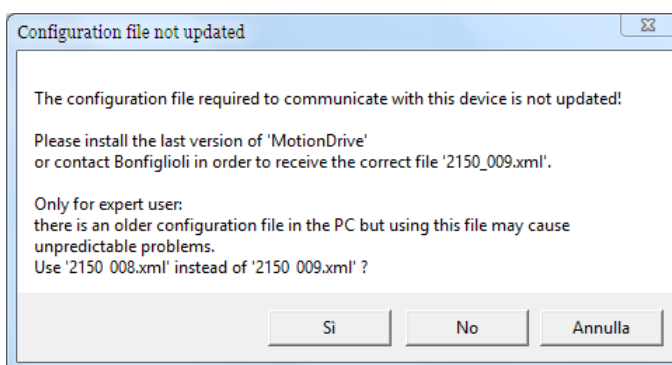
Configuration file not found

If the following window appears, it is necessary to update the MotionDrive Configuration files according to what is reported in [Section 11.3, Updating the Configuration File](#).



Configuration file not update

If the following window appears it is advisable to update the MotionDrive Configuration files according to what is reported in [Section 11.3, Updating the Configuration File](#).

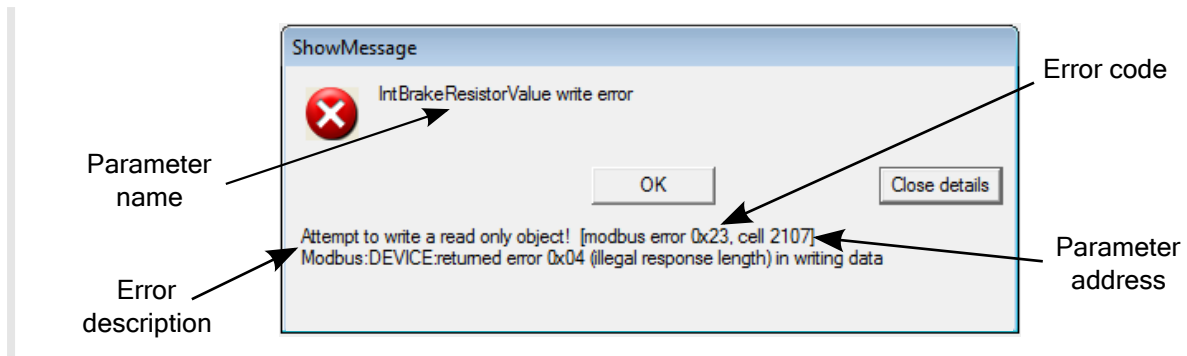


⚠ ATTENTION

In case of urgency and if it is not possible to update the Configuration files (see [Section 11.3, "Updating the Configuration File"](#)), it's possible to connect to the power supply by using the Configuration file proposed only to expert users. By using not updated Configuration files, Bonfiglioli Mechatronic Research S.p.a does not guarantee the correct working of MotionDrive.

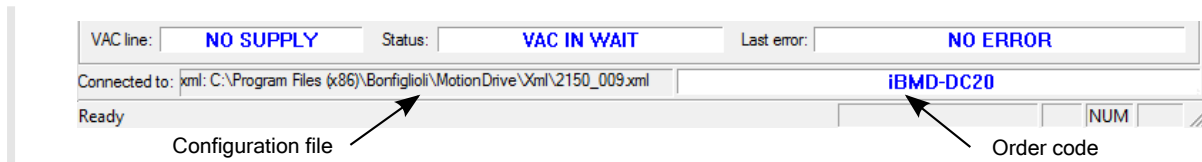
Generic errors

When you have communication errors, MotionDrive shows some specific messages. To understand the information in the error generic message see the following picture and the [Table 10.3](#).



4.4. Connection status with MotionDrive

The connection status is made up by the Configuration File and by the Order code, which can be found in the last line below in the tab Main. For further information see [Section 11.3, Updating the Configuration File](#) and [Section 14.1, OrderCode](#).



4.5. Disconnection of MotionDrive

When the connection between MotionDrive and the power supply is interrupted you will see the following window.



Retry try to connect again with the last [Connection parameters](#) used.

Offline go to mode [Offline](#).

Reconnect open a new connection.

Close close the programme.

4.6. MotionDrive options

The MotionDrive options refer to the program working mode, particularly with its messages transmission. Access:

Main menu > View > Options > General options.

The choices done by the user by interacting with the MotionDrive message service are saved in this page and can be modified in any moment.

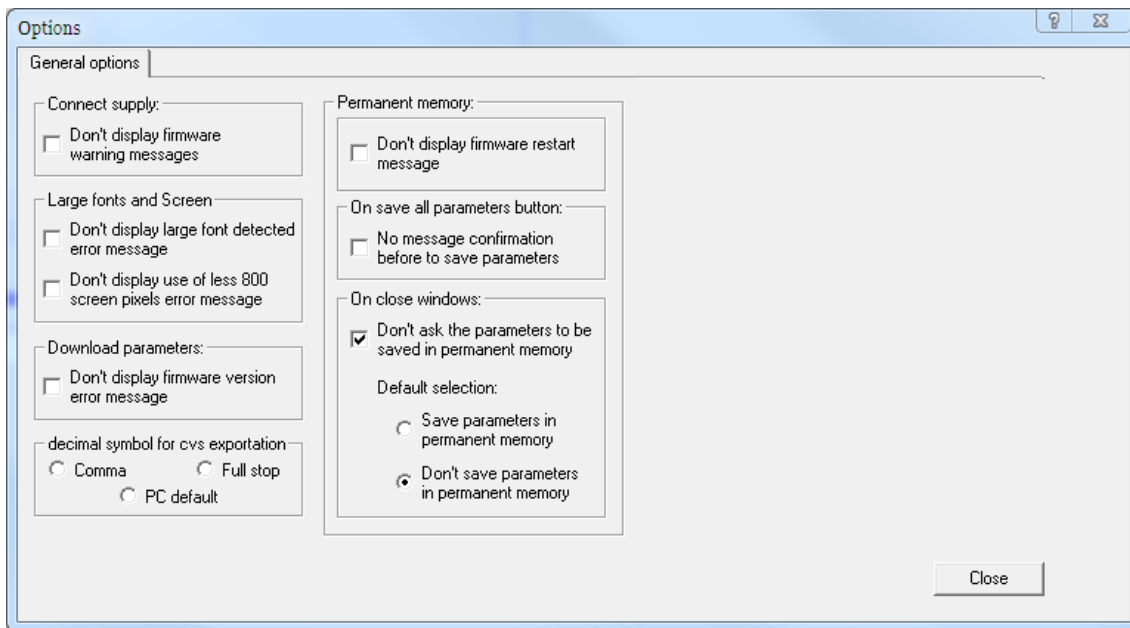


Figure 4.3. Default configuration of MotionDrive options

- *Connect supply*: notice of obsolete firmware while connecting (only for some firmwares)
- *Large fonts and Screen*: notice at the start-up in case some screen graphical options are not compatible with MotionDrive
- *Download parameters*: error notice during the download of the parameters file (only for some firmwares)
- *Decimal symbol for cvs exportation*: choice of the separating character to export the oscilloscope data to a file
- *Permanent memory*: notice of firmware reboot when the default parameters in the permanent memory are restored (only for some firmwares)
- *On save all parameters button*: saving confirmation in the permanent memory of the modifications to the parameters
- *On close window*: automatic saving of the modifications to the parameters in the permanent memory at the Supply setup closure.

Chapter 5

Quick Start

For a quick test installation of the *iBMD-DC* power supply, follow what is reported in this chapter.

5.1. Before starting



Before installing the power supply, read the paragraph on safety [Section 2.8, Safety precautions and limits](#). If you do not follow the safety instructions you may damage the equipment or be hurt.

Requested instruments, materials and equipment

Considering that the system input voltages has been correctly selected (see [Table 6.1](#) and [Table 6.2](#)) even the following points have to be considered.

For the correct functioning of the power supply, protection included, the installation of the following components is required:

- **short circuit protection device** (fuses on the LINR power input): it has to promptly protect the internal power electronic of the *iBMD-DC* when a short circuit happens on HVDC (see the fuse characteristics in [Table 6.1](#) and [Table 6.2](#)). The system instead

automatically protects itself in case of overload, overtemperature, etc. (see "Power And Control Protection" in the [Table 6.4](#))

- **Power contactor** commanded by the RTO contact (Ready To Operate)¹: The RTO contact allows to activate/deactivate the power contactor. If a FAULT is detected or there are not the right conditions, the RTO contact opens, cuts the supply to the contactor and the power supply input voltage is cut off.
- **Brake Resistor connection**: check that the [X1 Brake Resistor](#) connector is configured and inserted in the system. (for details see [Section 6.6, Brake resistor](#)).

There are other aspects to be considered that, unlike the previous ones, don't cause any damage to the power supply, but may cause a fault:

- **Hold Up 24V time check (X3 Control supply)**: in absence of the control section voltage the controls and the piloting of the internal circuits of the power supply don't work. In particular, when the control section voltage decreases under the [Input voltage missing on control section](#) threshold the RTO contact is immediately opened. In particular it must be guaranteed the voltage to the control section for at least 10 seconds since the input alternate line voltage is missing.
- **HVDC Ready status check**: in order to move the servomotors that are connected to the power supply without fall in Fault situations, undervoltage or excessive ripple on the HVDC voltage, it's necessary to wait that the power supply is in the operative status. A way to verify this status is to refer to the OUT0 digital output logical state (for details of this output see [HVDC Ready](#)).

5.2. Hardware installation

5.2.1. Installation precautions



 DANGER

Electric shock and isolation loss in case of foreign elements or power supply breaking.

- The presence of conductive foreign elements inside the product, as chippings, screws or pieces of metallic wire, may put out of order the implemented protections for the correct functioning.



 DANGER

¹If the power contactor and the RTO contact are not used, the provided internal protections fail. The power supply can be permanently damaged.

Danger of electric shock in case of inadequate grounding.

- An inadequate grounding exposes to electric shock risk.
- Connect the system to the ground BEFORE to apply voltage.
- Don't use the cable holder pipes as protection conductors, but a protection conductor inside the pipe.
- The protection conductor section must comply with the regulations in force.
- Connect the cables shields to the ground as reported in the diagram of [Figure 7.1](#)



⚠ DANGER

Differential switch use: this product may cause the presence of a leakage current in the protection conductor. If the installation regulations prescribe a protection for the direct or indirect contact connected upstream, that has to be done with a differential switch (RCD) or a leakage current monitoring device (RCM), on the power supplies must be installed a device of "type B".

NOTE

If two of the three line phases are interrupted, the leakage current may reach higher levels (7÷8 times) compared to the values that there are with all the three phases present.



⚠ DANGER

Very hot surfaces

- Depending on the functioning conditions, the product metallic surface may reach temperature higher than 90°C. Avoid any contact with the metallic parts. Do not put near any flammable or sensitive to the heat components. Observe the precautions about the heat dissipation.
- The ventilation system in the electrical cabinet must be able to dissipate the heat that's produced by all the devices and components that are inside installed.

5.2.2. Mechanical installation

For the system installation use the 4 holes on the power supply posterior flange. The dimensions are reported on the [Section 6.1, Dimensions and sizes](#). Be sure that the ventilation is free (see [Section 6.2, Power supply disposal and heat dissipation](#)), respecting however the maximum admitted environment temperature (see [Chapter 6, Technical features](#)).

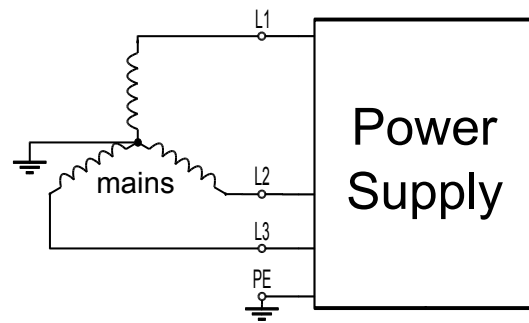
5.2.3. Voltage supply network

Check that the supply source is appropriate, according to the specifications in [Chapter 6, Technical features](#).

This power supply is made for a fixed connection on a TT and TN three-phase electrical network.

The short circuit nominal current of the electric line must be $\leq 5\text{kA}$.

Be sure that the input protection devices of the iBMD-DC power supply have an adequate interruption capacity.



 ATTENTION

The line-ground voltage must not be greater than 300VAC.

ADVICE

The line inductance use on the power supply input reduces the risk of damage against the voltage displacement between the line phases or the noises in the supply network. If the line inductances has to be used, the recommended reactance values are about 2%. If necessary, higher values can be selected, that may cause a greater voltage dip and on consequence, in the connected servomotors, a torque reduction with high speed.

5.2.4. Connection of the protection conductors

Two grounding connection are provided: one through the [X2 Power Line](#) connector (functional earth), the other through [Grounding screw connection](#) (protection earth).

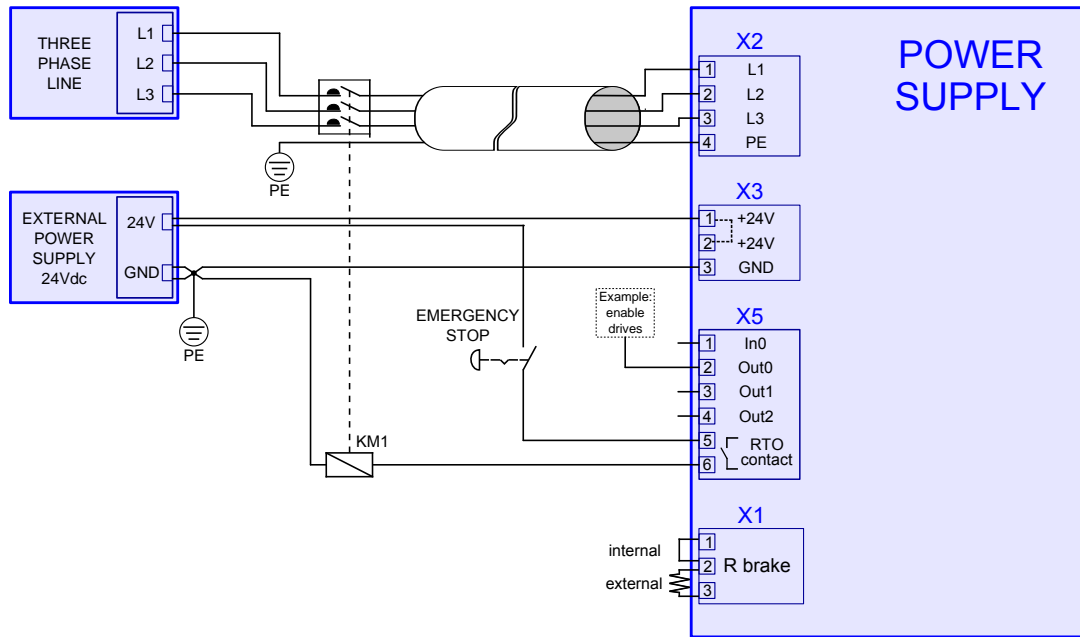
5.2.5. Connection of the supplies and RTO contact

Connect the supplies and the RTO contact to the power supplies as shown in the following scheme.



 DANGER

Before proceeding, check if the power and control supplies are switched off and there is no more voltage in the connection terminal boards.



To connect the pins of **X2 Power Line**, please pay attention to what is shown in the following table:

PIN	Signal	Description
1	L1	Line phase 1
2	L2	Line phase 2
3	L3	Line phase 3
4	PE	Protection Earth

To connect the pins of **X3 Control supply**, please pay attention to what is shown in the following chart:

PIN	Signal	Description
1	+ 24V	+24Vdc Control Supply
2	+ 24V	+24Vdc Control Supply
3	GND	Ground Control Supply

To connect the pins of **X5 Input/Output**, please pay attention to what is shown in the following chart:

PIN	Signal	Description
1	IN0	Reset Fault
2	OUT0	HVDC Ready
3	OUT1	VacLine STATE
4	OUT2	Fault
5	RTO	RTO Contact
6		

The RTO function allows to deactivate the power voltage in case there is a fault.

**WARNING**

If a **FAULT** is detected the RTO contact opens the contactor that supplies the voltage to the iBMD-DC.

5.2.6. Connection of the serial port

For a detailed control of all the provided functionalities of the iBMD-DC, connect the RS232 serial port to the **X6 COM port** connector of the power supply.

**WARNING**

Connect and disconnect the communication connector only when the power supply is switched off. Check if the pin 5 (Ground Control supply) of **X6 COM port**, the power supply and the PC are correctly connected to the protection conductor.



To connect the pins of **X6 COM port**, please pay attention to what is shown in the following table:

PIN	Signal	Description
1	-	Not connected
2	-	Not connected
3	COM Selection	short circuit = RS232, open circuit = Not implemented
4		
5	GND_COM	Ground RS232
6	TX232	Transmit Data RS232
7	RX232	Receive Data RS232
8	PE	Protection Earth

5.2.7. Confirmation of the connections

After having completed the connections, check if they are correctly connected and switch on the power supply of the control section (24Vdc) and of the power section. The leds on the *iBMD-DC* front, should have the following configuration.

- LED "RTO" GREEN ON; Closed contact;
- LED "CPU STATUS" GREEN ON; CPU working in firmware mode;
- LED "POWER STATUS" GREEN ON; power section correctly supplied;
- LED "BRAKE STATUS" OFF; Brake not active;

If the leds status is not one of the above described, see [Section 7.3, Leds](#).

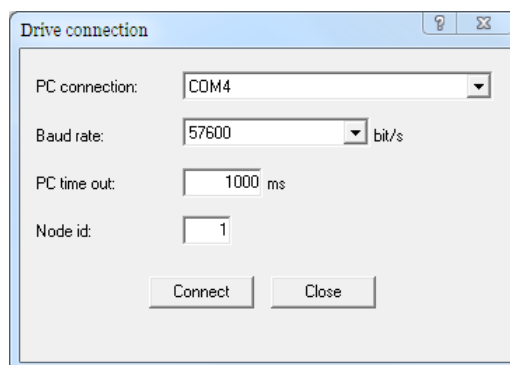
5.3. Setup software

1. MotionDrive installation

Install the last available version of MotionDrive that can be downloaded from the <http://www.bonfiglioli.com> website or that is directly provided by Bonfiglioli. Accept the configurations proposed by the installation procedure. For further details see [Section 3.2, Installation](#).

2. Starting MotionDrive

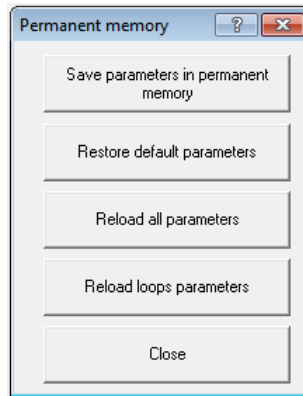
Start MotionDrive from: **Start menu > Programs > Bonfiglioli > MotionDrive** and set the [Connection parameters](#) in the proposed window *Drive connection* .



In case of problems see [Section 4.3, Communication errors with MotionDrive](#).

3. Configuration restoring

To restore the default configuration, it's sufficient to click the  button in the *Permanent memory* window (**Main menu > Supply > Permanent memory...**)



Chapter 6

Technical features

iBMD-DC20			
Power section	Minimum rated voltage	Rated voltage	Maximum rated voltage
Three-phase rated voltage ^a	230Vac	400Vac	480Vac
System voltage (nominal voltage between a phase and ground)	MAX 300V [overvoltage category III]		
Input voltage range	180 ÷ 520Vac (50/60Hz)		
Line voltage displacement	<3% of the input fundamental voltage		
Line filter	Integrated		
Line fuses: quick acting (in charge to the user)	$32A - I^2T_{max} = 700A^2s$ ^b		
Input current ^c	22Arms	25Arms	23Arms
Input current with line inductance ^d	-	17Arms	-
Output nominal voltage ^e	324VDC	564VDC	677VDC
Output nominal current @ 40°C	20A	20A	16,7A
Output maximum current (≤ 5 sec)	40A	40A	33,4A
Output nominal power @ 40°C	6,5kW	11,3KW	11,3KW
Power pulse (≤ 5 sec)	13kW	22,6KW	22,6KW
Internal capacity	940μF		

iBMD-DC20			
Power section	Minimum rated voltage	Rated voltage	Maximum rated voltage
Dissipated power (Rbrake dissipation excluded and output nominal current)	100W		

^aNo other kinds of wiring are allowed. See [Section 5.2.3, "Voltage supply network"](#)

^bExample: Bussmann cod. FWP-32A14F, or ITALWEBER AQS-F14x51 cod.1480032

^cwithout line inductance and with output nominal current

^dValue with line inductance of 1mH

^eThe output voltage depends on the three-phase nominal voltage

Table 6.1. Electrical features of the iBMD-DC20.

iBMD-DC40			
Power section	Minimum rated voltage	Rated voltage	Maximum rated voltage
Three-phase rated voltage ^a	230Vac	400Vac	480Vac
System voltage (nominal voltage between a phase and ground)	MAX 300V [overvoltage category III]		
Input voltage range	180 ÷ 520Vac (50/60Hz)		
Line voltage displacement	<3% of the input fundamental voltage		
Line filter	Integrated		
Line fuses: quick acting (in charge to the user)	50A – I ² T _{max} = 1300A ² s ^b		
Input current ^c	42,5Arms	47Arms	42Arms
Input current with line inductance ^d	-	34Arms	-
Output nominal voltage ^e	324VDC	564VDC	677VDC
Output nominal current @ 40°C	40A	40A	33A
Output maximum current (≤ 5 sec)	80A	80A	66A
Output nominal power @ 40°C	13kW	22,5KW	22,5KW
Power pulse (≤5sec)	26kW	46KW	46KW
Internal capacity	1500µF		
Dissipated power (Rbrake dissipation excluded and output nominal current)	200W		

^aNo other kinds of wiring are allowed. See [Section 5.2.3, "Voltage supply network"](#)

^bExample: ITALWEBER cod. AQS-F22x58 Cod.1482050

^cwithout line inductance and with output nominal current

^dValue with line inductance of 1mH

^eThe output voltage depends on the three-phase nominal voltage

Table 6.2. Electrical features of the iBMD-DC40.

Control section	iBMD-DC20 & iBMD-DC40
Rated voltage	24Vdc +/- 10%
Internal protections	Fuse: 4AT Polarity reverse
Absorbed current @ 24Vdc (only control section)	0,6A (Digital output OFF) ^a
ADDITIONAL absorbed current @ 24Vdc (with turned on outputs)	See Table 6.14
Digital outputs	Output voltage: 24 Vdc Type: PNP output

Control section	<i>i</i> BMD-DC20 & <i>i</i> BMD-DC40
	Output current= 0,3A ^b
RTO contact	Maximum voltage: 30Vac/Vdc Maximum current: 1A

^aIt can reach 1,4A for 100ms when the (AC) line voltage is applied to the *i*BMD-DC and there is the transition from the *HVDC CHECK* to the *Operational* status (see [Chapter 8, Power supply logical states](#))

^bThe voltage that's provided to the outputs depends on the voltage that's provided to the control section through the [X3 Control supply](#) connector

Table 6.3. Control section electrical features.

Other data	<i>i</i> BMD-DC20 & <i>i</i> BMD-DC40	
Braking circuit	Maximum current pulse	50A (repetitive) ^a
	Maximum activation threshold	785VDC
	Hysteresis value	20VDC
Internal brake resistor	Resistor	33Ω
	Power	120W
	Power pulse	20kW (0,3sec)
Power and control sections protection	Overload of the output current	Yes
	CH1 cable overload	Yes
	CH2 cable overload	Yes
	Brake circuit short-circuit	Yes
	Braking energy overload	Yes
	Charging energy overload	Yes
	HVDC undervoltage	<100Vdc
	HVDC overvoltage	>830Vdc
	Excessive ripple on HVDC	Yes
	Over temperature	Power(>90°C) ; control (>85°C)
	Control section under voltage	<18,3Vdc
Mechanical Shock according to the IEC 60068-2-27 standard 3 shocks per direction, on 3 axes. Pulse duration of 11ms.	20g	
Sinusoidal vibration according to the IEC 60068-2-6 standard from 5 to 500 Hz, on 3 axes.	2g	
Working environment temperature	0 ÷ +40 °C	
Storage ambient temperature	-20 ÷ +50 °C (for long storage time) -20 ÷ +70 °C (for short storage time)	
Humidity related to storage and working (without condensation)	+5 ÷ +95 %	
Weight	About 5,8 Kg	
Maximum altitude	4000m [m.s.l.]	
Ventilation	<i>i</i> BMD-DC20 → Natural ventilation <i>i</i> BMD-DC40 → Forced ventilation, with cooling fans	
Pollution degree	2 ^b	

Other data	iBMD-DC20 & iBMD-DC40
Protection degree	IP20

^aPay attention to the dimensioning of the external resistor.

^busually only dry pollution, non-conductor. Occasionally, however, can be considered a temporary conductivity, due to the condensation (power supply not working).

Table 6.4. Generic features

NOTE

the power values are referred to the maximum allowed functioning environment temperature, that is 40°C.

6.1. Dimensions and sizes

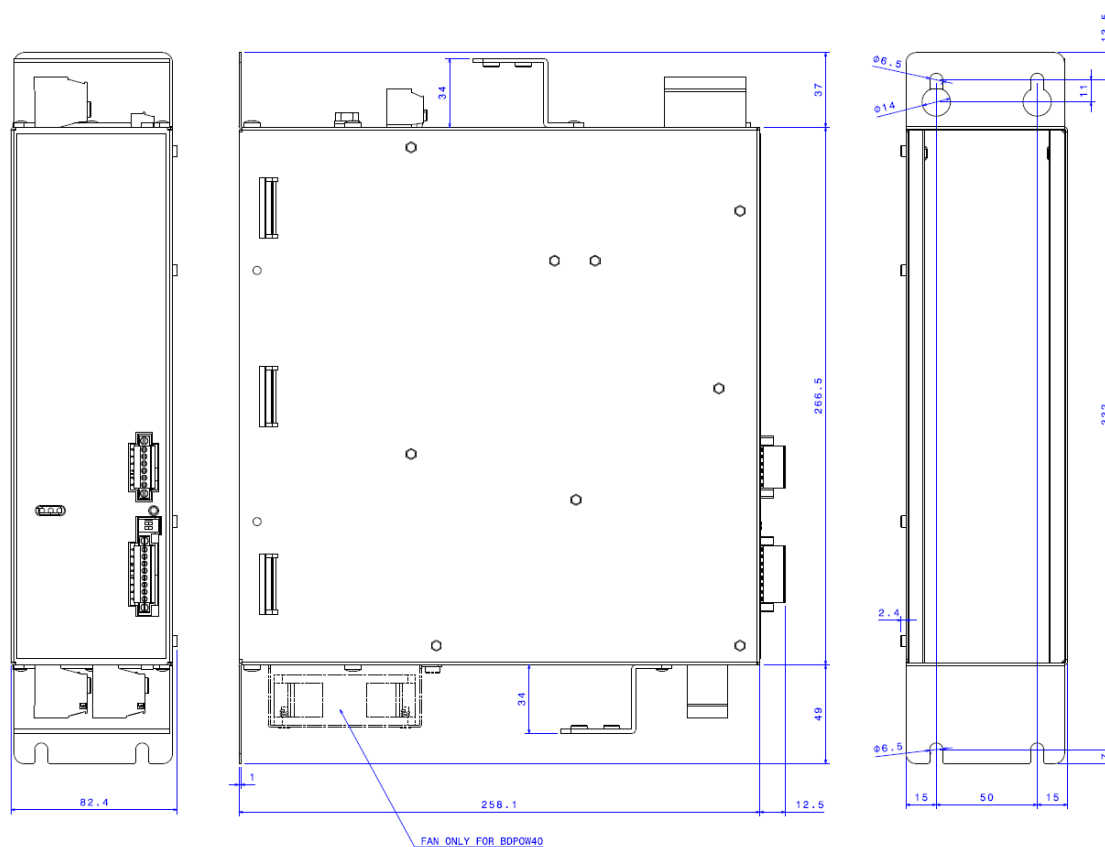


Figure 6.1. iBMD-DC dimensions.

- Fixing mode: on the background plate of the electrical cabinet;
- Indicative weight: about 5,8Kg.

6.2. Power supply disposal and heat dissipation

The power supply correct installation requires that it is installed in vertical position and strongly fixed to the electrical cabinet background plate. Save at least 10cm free on the

upper and lower sides and 5cm on the lateral sides, and avoid hot zones of the electrical cabinet.

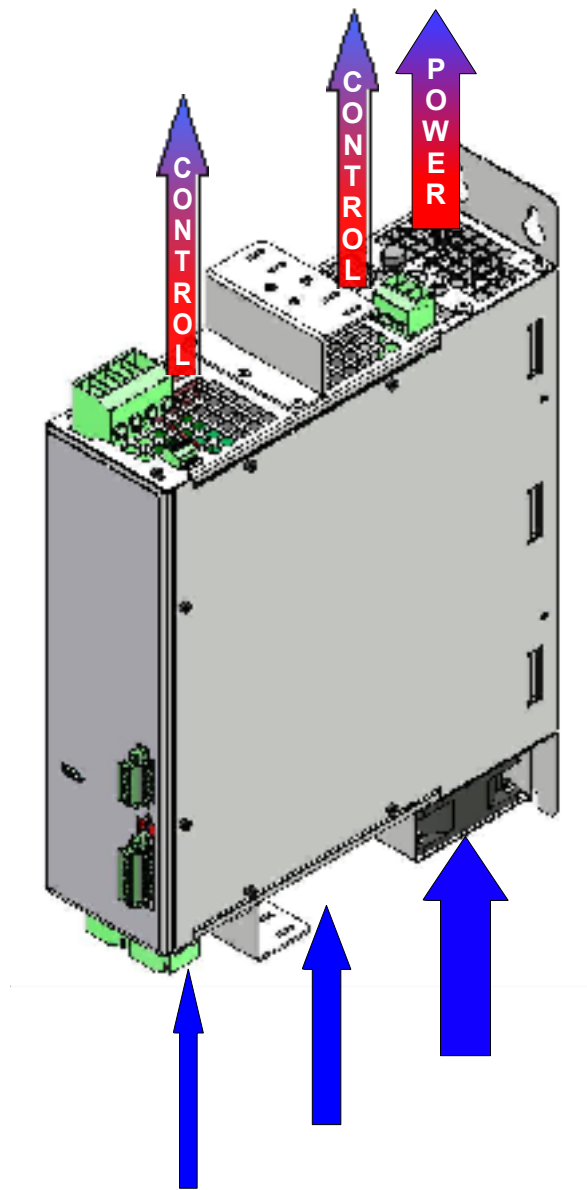


Figure 6.2. iBMD-DC disposal and heat dissipation.

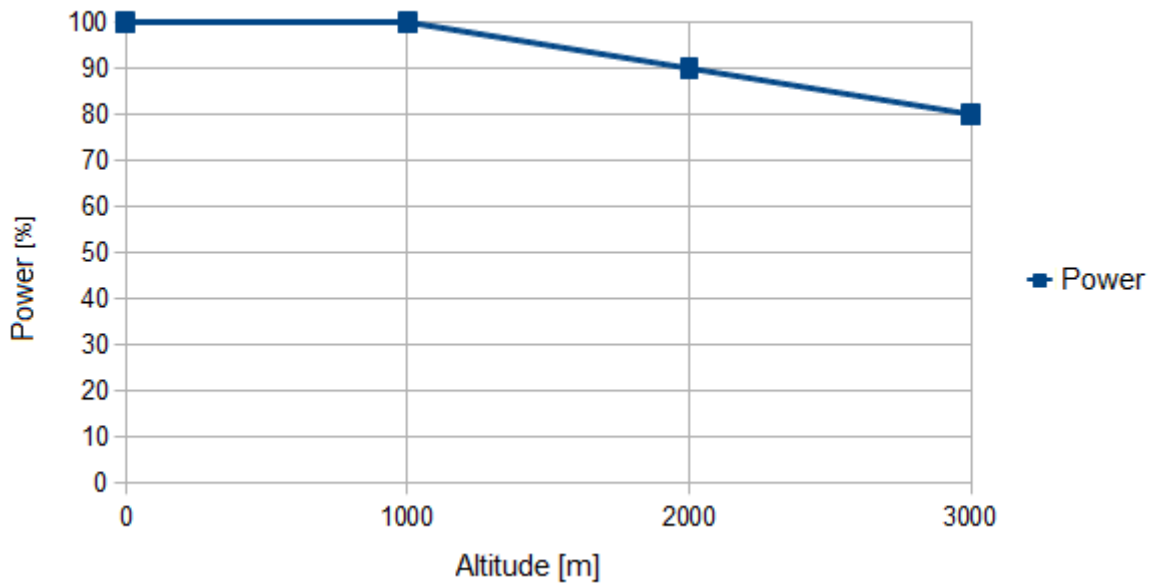


Figure 6.3. Output power derate in relation to the altitude.

The output power depends on the dissipation degree of the power supply with the external environment ; in case the dissipation is not sufficient, then the **Overtemperature of power section** alarm intervenes.

The thermal protection of the power section intervenes when the heat sink exceeds the temperature of 90°C.

The output current is maintained if the environment temperature doesn't exceeds the 40°C and if the brake resistor doesn't generate an excessive heat.



⚠ DANGER

It is recommended to not touch the power supply while it is powered: its surface may be hot. This also applies after the turn off, the box and/or the fin may be hot: wait that it became cool before to touch it with hands.

6.3. Input section

For the system functioning two supplies are necessities:

- for the control section: a DC voltage (continue voltage)
- for the power section: an AC three-phase voltage (alternate voltage)

IMPORTANT

The contactor that controls the power section supply is commanded by the control section through the RTO contact. For further details see **Section 6.7, RTO contact: Ready To Operate.**

There are no restrictions about the supply sequence: it can be provided the control voltage supply first and then the power one, and vice versa. But without the control section voltage the system doesn't turn on, therefore in this situation the leds don't light and it's not possible any communication (even if the power voltage is present). In [Table 6.1](#), [Table 6.2](#) and [Table 6.3](#) there are the limits of the control and power sections voltage.

6.3.1. Fuses

Control section

The power supply is provided, internally to the logic section, of a NON REPLACEABLE (and non auto-restoring) fuse. The fuse breaking probably implies a damage of the electronics: in this case please contact Bonfiglioli Mechatronic Research S.p.a

Power section

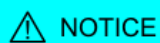
Internally to the power section there are no fuses. It must be the user that externally provides with the insertion of 3 fuses in the three-phase lines, according to the regulations that are reported in the technical data tables (see [Chapter 6, Technical features](#)).

6.3.2. Line inductances

The line inductances in the input reduce the risk of damage against the voltage displacement between the line phases or the noises in the supply network. If the network doesn't have any voltage displacement, the *iBMD-DC* doesn't need line inductances. When, instead, it's necessary to use them, reactance values of 2-4% are recommended. If necessary, higher values may be chosen, that may imply a reduction of the performance on the connected systems (torque reduction at high speeds), due to the voltage dip.

For example, high noises can be caused by the following factors:

- Devices for the power factor adjustment, connected near the converter.
- Big converters in d.c. without line inductances or with inadequate components connected to the supply.
- Motor/s with direct start-up in line connected to the voltage supply so that, at the motion start of one of this motors, the voltage decreasing is higher than the 20%



NOTICE

These noises may provoke the passage of excessive peak currents in the power supply power input circuit, causing not expected alarms.

Inductances current

For the line inductances current dimensioning, the following rules must be respected:

- Continuous service current: not lower than the *Input current* in continuous service to the power supply
- Repetitive peak current: not lower than twice the *Input current* in continuous service to the power supply

ADVICE

Refer to the "Input current" reported in [Table 6.1](#) and [Table 6.2](#).

6.4. Output section

The power supply provides the output HVDC voltage through the [X7 e X8 Power Output](#) connectors (CH1 and CH2). This voltage is contemporary present in both channels. If one of them goes in error, then the entire system switches in fault status and, on consequence, the voltage will not be present neither on the other one.

⚠ WARNING

The CH1 and CH2 channels are not electrically isolated, so the voltage is always present on both. If, for example, only one channel is used, the voltage is anyway present even on the other one that's not used.

The current data (*Nominal output current @ 40°C*) declared on [Table 6.1](#) and on [Table 6.2](#) correspond to the total value of the current that's provided by the power internal section. This current is divided in the CH1 and CH2 outputs, that respectively measure their values through two amperometers A1 and A2, as showed in the following diagram.

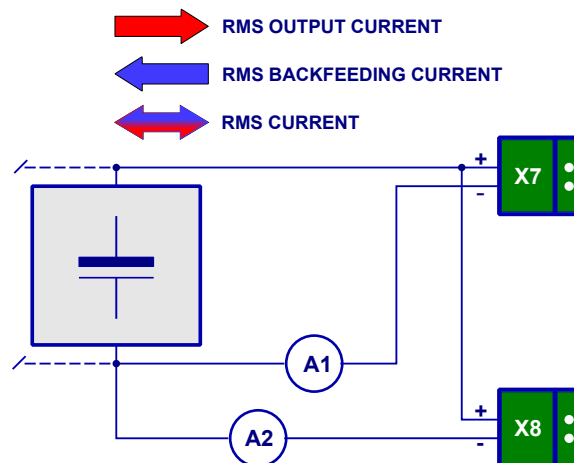


Figure 6.4. Output section electrical scheme.

The [RMS_OutputCurrent](#), [RMS_BackfeedingCurrent](#) and [RMS_Current](#) currents can be distinguished for each output or overall (calculated from the values that are detected by the 2 amperometers A1 and A2).

- [RMS_OutputCurrent](#): is the provided current (positive component only)
- [RMS_BackfeedingCurrent](#): is the return current (negative component only)

- **RMS_Current**: is the total current (provided and return) that includes both the current values (positive and negative)

That means that, for each current measurement, we will have a value that's related to the single output and a total one, as reported in the following table:

Channel 1	Channel 2	Total
RMS_OutputCurrentCH1	RMS_OutputCurrentCH2	RMS_OutputCurrent
RMS_BackfeedingCurrentCH1	RMS_BackfeedingCurrentCH2	RMS_BackfeedingCurrent
RMS_CurrentCH1	RMS_CurrentCH2	RMS_Current

Table 6.5. Detected current values.

In the following table the power outputs electrical features, related to the rated voltage (see [Table 6.1](#) and [Table 6.2](#)), are reported:

FEATURES	iBMD-DC20	iBMD-DC40	DESCRIPTION
Output n°	2		CH1 and CH2 OUTPUTS through X7 e X8 Power Output
CH1 and CH2 parallel connection possibility	YES		Through appropriate wiring (see Section 7.2.3, Output section connection)
CH1 and CH2 cables protection current separated setting possibility	YES		To set the current limits on the output cables, use the CableCurrentLimit(CH1) and CableCurrentLimit(CH2) parameters.
Maximum total current that can be provided (CH1 + CH2)	20A	40A	-
Maximum current that can be provided by a single output (with the other one disconnected or without load)	20A	25A	-
Maximum protection RMS current on each output	25Arms	25Arms	Fixed value, cannot be set, that protects the device.

Table 6.6. CH1 and CH2 power outputs electrical features.

6.5. Charge circuit and start-up phase

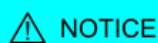
The charge circuit limits the capacitor charging current at the start-up of the power supply.

In the circuit an over energy and a voltage level control have been implemented against the over heating or the breaking of the circuit itself.

The protection parameters of the start-up circuit are:

Internal charge resistor	
Energy	3000 [J]
Power	60 [W]
Resistor	100 [Ω]

Table 6.7. Internal charge resistor parameters



repetitive start-up may cause to the charge circuit a fault situation due to an excessive transferred energy. It's advisable to not activate/deactivate too frequently the power supply.

In general, the dissipated energy on the start-up depends on the VAC Line voltage on the system input and on the load current that's present on the power supply output. The worst cases will be with the maximum voltage on VAC Line and a high output current.

About the output current value, it is usually negligible because the connected devices don't absorb current during the start-up phase (e.g. servo driver).

- During the start-up the output load must mainly be capacitive.
- The power supply start-up takes about 2 sec to 4 sec.

6.5.1. Charge circuit functioning

NOTE

In order to understand the meaning of the signals that are analyzed in the following graphs, refer to [Figure 2.2](#).

Normal start-up: during the start-up, the charging time is about 2 sec. During this time the HVDC voltage value must increase until it's within 50V from the VBRIDGE, that is $\Delta V1$ (difference between VBRIDGE and HVDC) must be less or equal to 50V. If this situation, represented in the following chart, verifies, then the start-up phase finishes and the power supply switches to the next phase (OPERATIONAL logic status).

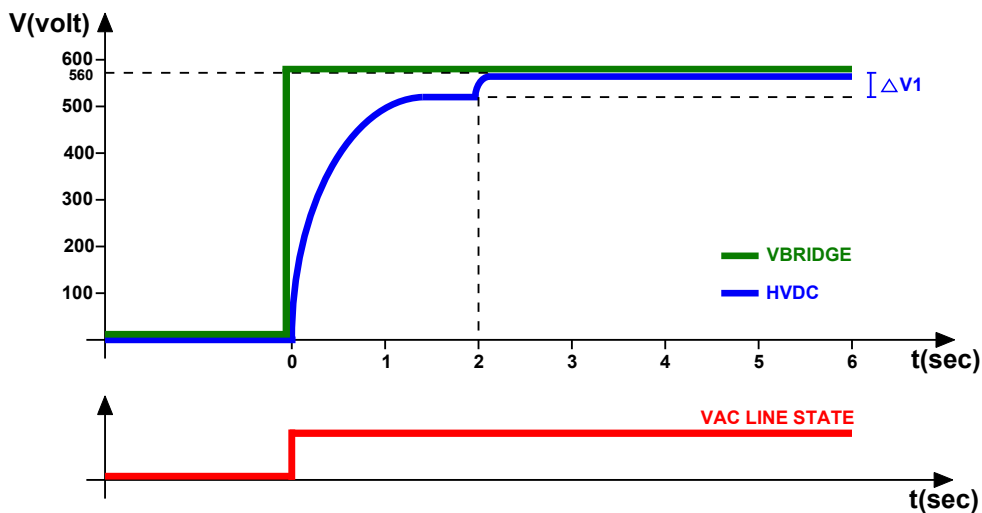


Figure 6.5. Example of normal start-up with input voltage VACLine = 400Vac.

Prolonged start-up: in this case the HVDC voltage increasing is very slowed due to a big capacitive load connected to the output, and that determines a considerable increasing of the charging time. In fact it happens that, unlike the previous case, the voltage value is not sufficient to obtain a $\Delta V1$ lower than 50V within 2 sec, and so the charging time is prolonged to 4 sec and a new control is done ($\Delta V2$). As in the previous phase, if the difference between VBRIDGE and HVDC reaches a value that's lower than 50V, that charging phase successfully ends and the power supply switches to the next phase (OPERATIONAL logic status) and no fault condition is reported. This second case is reported in the following chart.

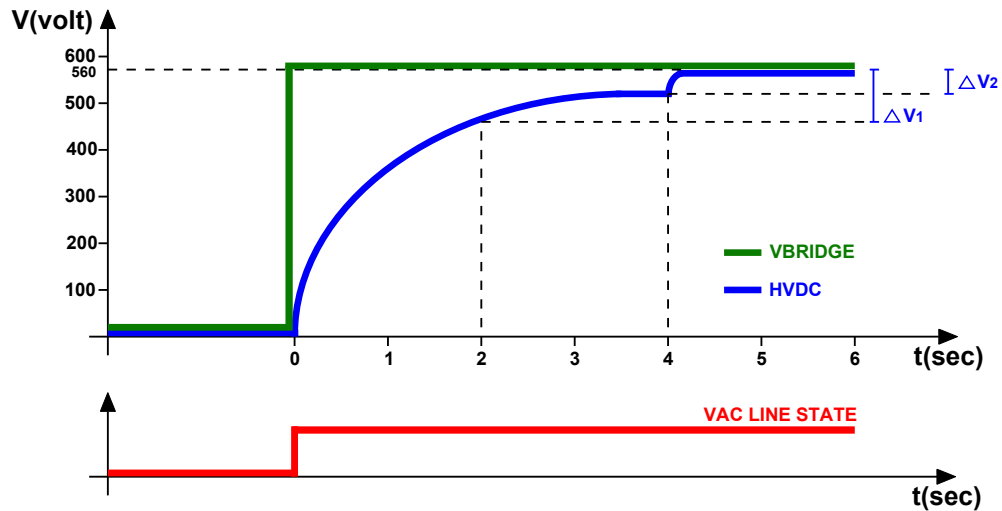


Figure 6.6. Example of prolonged start-up with input voltage $VACLine = 400Vac$.

Prolonged start-up with fault: if neither after 4 sec the HVDC voltage value has reached the $[VBRIDGE - 50V]$ threshold because of the excessive load on the output, the power supply switches to the Fault status (**Internal circuit ripple exceeds the limit on power section**). This failed start-up case is reported in the following chart.

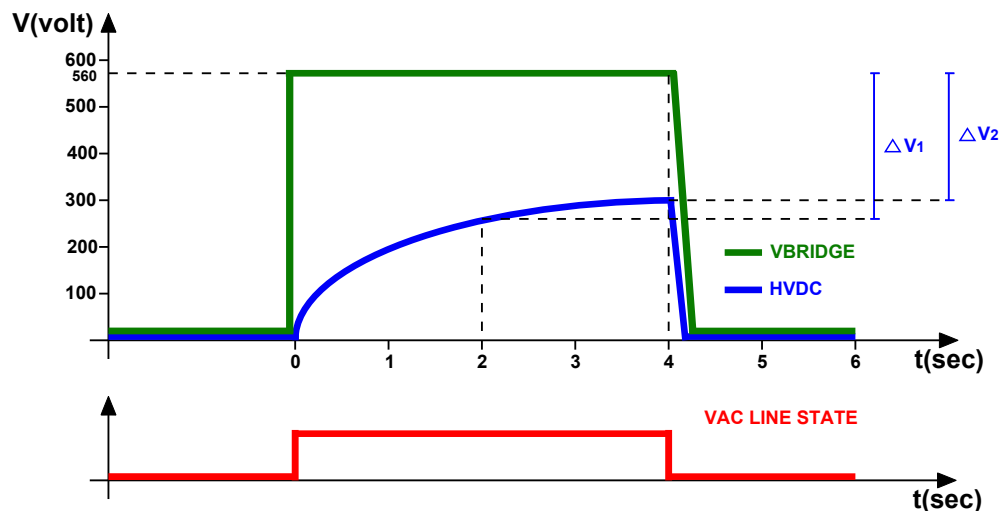


Figure 6.7. Example of prolonged start-up with fault with input voltage $VACLine = 400Vac$.

During the charging phase some other fault types may happen, and the most probable one is **Charge circuit energy overload**.

6.6. Brake resistor

This device limits the voltage on HVDC during the regeneration operations by the servomotors, for example during the braking phase. If the voltage exceeds the threshold value (**BrakingCircuitActivationVoltage**) the brake resistor is activated. In this case the exchanged energy between servomotors and power supply turns into heat.

If the energy that's regenerated by the motors is higher than the expected one (see **IntBrak-ResistorNominalEnergy** if internal resistor and **ExtBrakeResistorNominalEnergy** if exter-

nal resistor) the **Overvoltage of HVDC output during braking** warning or the **Braking circuit energy overload exceeds the limit** fault may appear. It's required the use of an external resistor that has higher electrical features, compared to the internal resistor ones (the [Section 7.2.5, Brake resistor](#) reports the internal or external brake resistor connection notes).

Value of Brake-CircuitSelector	Parameters	Dimensioning
0 (internal)	IntBrakeResistorValue, IntBrakeResistorNominalEnergy, IntBrakeResistorNominalPower	Not necessary
1 (external)	ExtBrakeResistorNominalEnergy, ExtBrakeResistorNominalPower, ExtBrakeResistorValue	See Section 6.6.1, "External brake resistor minimum value calculation"
2 (internal + external)	The parameters in this configuration are the same that are used when only the internal resistor is used.	See "Internal brake resistor" in the Table 6.4

Table 6.8. Parameters that have a different implication depending on the selected RBrake.

⚠ ATTENTION

The brake resistor use assure HVDC voltages within the range. A wrong dimensioning (OVERLOAD) may break the resistor or the electric circuit and damage the machine/system. Furthermore it can cause grave injuries, for example in lifting up operations.

In particular, in the configuration 2 with "internal + external" RBrake, the external resistor parameters MUST be the same of the internal one (see [Table 6.4](#)).

ADVICE

In case the internal resistor is not sufficient to dissipate the braking energy, the most useful solution is the one with "internal + external" Rbrake, because the doubling of the brake energy, power and current is obtained, without change any default parameter.

In this configuration, due to the presence of the external resistor connected in parallel, the [BrakeEnergy](#), [BrakeEnergyOverloadPercentage](#), [MaxBrakeEnergy](#) real values will be the double of the measured ones, that are related to the internal resistor only.

⚠ DANGER

In case the **Braking circuit energy overload exceeds the limit** fault condition occurs, some residual currents will be present (because, due to the fault condition, the brake circuit is deactivated before the voltage is increased up to the correct level).

Before to execute any inspection operation on the iBMD-DC wait at least 10 minutes.

During the test and the calculations keep in mind that, in case of a higher network voltage, in the DC bus capacitors can be stored a lower quantity of braking energy and that this energy is absorbed by the braking circuit.

To evaluate the usage level of the circuit that commands the braking resistor, it's possible to control the status and the colour of the BRAKE STATUS led (for details see [Table 7.4](#)). This shows the brake resistor activation (On=active, Off=not active). If it activates and the led colour is green, it means that the braking circuit energy is lower than the 50%, if instead the led becomes red it means that the energy is higher or equal to the 50%, if the energy of the circuit that commands the braking resistor exceeds the limit value (**Braking circuit energy overload exceeds the limit**) the RTO contact is opened and the functioning status switches from OPERATIONAL to FAULT (BRAKE STATUS led is off).

The RTO contact opening deactivates the *iBMD-DC* input power supply (see [Figure 7.1](#) to understand the correct connection of the RTO contact). On consequence, the HVDC output voltage will decrease according to the applied load.

6.6.1. External brake resistor minimum value calculation

The external brake resistor value must not decrease under a certain value in order to avoid a too high current. If only the external resistor is connected, the formula that has to be used is the following one:

$$R_{\min} = V_B / I_{p\max} \quad (6.1)$$

Where:

- R_{\min} = Minimum value of the external brake resistor
- V_B = [BrakingCircuitActivationVoltage](#)
- $I_{p\max}$ = Maximum current pulse ¹

IMPORTANT

The values of the external resistor can be only included in the ranges that are reported in [Table 6.9](#).

External brake resistor	
Resistor	16 ÷ 1000 [Ω]
Energy	100 ÷ 2000000 [J]
Power	100 ÷ 40000 [W]

Table 6.9. External brake resistor parameters range.

6.7. RTO contact: Ready To Operate

The RTO contact is used to activate/deactivate the contactor the provides the LINE power voltage (L1, L2 and L3 [X2 Power Line](#) connector) to the *iBMD-DC*. If there is a fault, the RTO contact opens and disconnect the power supply voltage.

The RTO contact is electrolytic and optoisolated from the internal circuits.

 **WARNING**

If the supply voltage is cut off from the RTO contact, the contactor is no more supplied and the power section is disabled.

The following table summarizes the RTO contact electrical features:

Type	NO (Normally Open) electronic contact ^a
RTO contact terminations maximum voltage (OFF state).	30 Vac / Vdc
RTO contact terminations maximum voltage (ON state).	1A
Protection from short-circuit	No

¹see [Table 6.4](#)

Type	NO (Normally Open) electronic contact ^a
Maximum allowed voltage between RTO (pin 5 or 6 of the X5 Input/Output connector) and GND (pin 3 of the X3 Control supply connector)	50V ^b

^aThis contact state depends on the internally implemented logical states. When the power supply is off the contact is opened (NO).

^bThe voltage limit must be obtained through a suppressor applied on the terminations of the contactor coil, as showed in Figure 6.8

Table 6.10. RTO contact electrical features

Electrical features needed by the contactor

In order to guarantee the correct power supplier functioning, the contactor must be chosen according to the electrical features that are summarized in the following tabel²:

Features	Values
Contacts opening time	< 150ms
Peak voltage generated by the coil	≤ 50V (limited by the suppressor)
Rated current/voltage of the power terminations	see Table 6.1 and Table 6.2

Table 6.11. Contactor electrical features

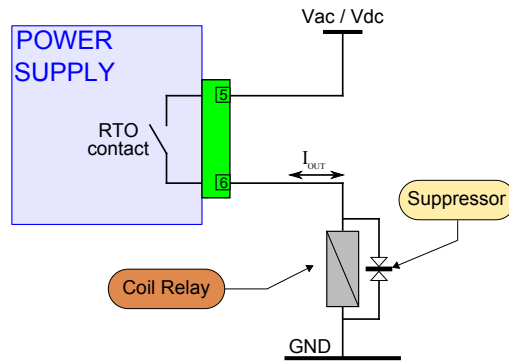


Figure 6.8. RTO contact wiring example.

⚠ ATTENTION

The contactor must respect the Opening time (that is the contacts opening time from the moment in which the coil supply is cut off). The Opening time increases about 10 times if snubber diodes are inserted on the inductance terminations. Therefore, use a suppressor.

IMPORTANT

If the suppressor is not already present in the contactor, add it externally.

6.8. Digital inputs and outputs

In the iBMD-DC power supply the following optoisolated digital inputs and outputs are provided:

²a contactor example could be the "LC1D32BL (Coil suppressor modules LAD4T)".

on the [X5 Input/Output](#) connector are presents:

- 1 PNP digital input (24Vdc)
- 3 PNP digital outputs (24Vdc; max 300mA)

digital I/Os at disposal for the iBMD-DC

Name	Type of resource / logic	Details
In 0	Input, PNP, 24V	Reset Fault, connection: pin 1 of X5 Input/Output
Out 0	Output, PNP, 24V	HVDC Ready, connection: pin 2 of X5 Input/Output
Out 1	Output, PNP, 24V	VacLine state, connection: pin 3 of X5 Input/Output
Out 2	Output, PNP, 24V	Fault, connection: pin 4 of X5 Input/Output

Table 6.12. iBMD-DC digital I/Os description

Electrical features of inputs ([Table 6.13](#)) and outputs ([Table 6.14](#)).

DIGITAL INPUT FEATURES	
Input n°	1
Galvanic isolation	YES, through optoisolators
Protection	Polarity reversal
Input voltage	<ul style="list-style-type: none"> • Nominal : +24Vdc • For LOW signal (physical state 0) : -30 ÷ +5Vdc • For HIGH signal (physical state 1) : +15 ÷ +30Vdc
Input current (typical) with Vin = 24Vdc	<ul style="list-style-type: none"> • 4,8 mA

Table 6.13. Digital input electrical characteristics

DIGITAL OUTPUTS CHARACTERISTICS	
Output type	PNP
Output n°	3
Galvanic isolation	YES, through optoisolators
Protection	Polarity reversal, overcurrent, short circuit
Supply voltage	24V (internally obtained from the 24V that are presents on X3 Control supply)
Maximum output current (for each output)	300mA

Table 6.14. Digital outputs electrical characteristics

NOTE
<p>In relation to what's reported on Table 6.14, on the 24V the absorption may increase until 900mA if the 3 outputs are all on and with the maximum load connected.</p>

RTO CONTACT FEATURES	
RTO contact	see Table 6.10

Table 6.15. RTO contact electrical features

6.8.1. Functionalities

Here are described the functionalities related to the I/O resources of the iBMD-DC.

Functionalities	relative I/O
Reset Fault	In 0
HVDC Ready	Out 0
Vac Line state	Out 1
Fault	Out 2

Table 6.16. Functionalities of the I/O resources

Reset Fault

The IN0 digital input function is Reset Fault, that tries the power supply restoring to the normal functioning, but if the fault remains the power supply doesn't restore.

for details about the Fault status restoring, refer to [Chapter 10, Fault and warning](#).

To force a Reset function it's necessary to apply a positive pulse of at least 100ms.

IMPORTANT

The IN0(Reset) input activates the Reset Fault functionality only when the power supply is in the fault status, when it is in the other statuses this input doesn't reset or restart anything. Even the automatic restart or from MotionDrive (see [Section 10.2, "Errors reset"](#)) is active only if the power supply is in fault status.



ATTENTION

When the Reset Fault is forced, a new restore attempt is started, with the generation of the HVDC voltage from the X7 e X8 Power Output connector (Power Output). Do not install any connections or make inspections when the power supply is charged. In such cases switch the power off, wait for at least 10 minutes, otherwise there can be risks of electric shock and/or damaging.

HVDC Ready

The OUT0 output is active (ON state, transistor on) when the power supply is in the operative status and without faults.

If a fault is reported, with the consequent RTO contact deactivation, the output becomes inactive (OFF status, transistor off).

This output can then provide the consent for the motion of the motors that are supplied by the iBMD-DC HVDC voltage.

Vac Line state

The OUT1 output indicates the alternate voltage status on the X2 Power Line connector (Power Line).

This output is active (ON state, transistor on) when on the system input an alternate three-phase or two-phases voltage is present and it's higher than the minimum expected value (see "Absolute range voltage" in [Chapter 6, Technical features](#)).

The delay time since when the alternate current is missing is about 20ms.

Fault

The OUT2 output indicates the power supply fault status, when it is on it indicates that a Fault has been detected with consequent deactivation of the HVDC output voltage.

Chapter 7

Electrical connections, leds and dip switches

7.1. Installation notes

ATTENTION

The *iBMD-DC* systems must be installed by specialized personnel only that must have an in-depth knowledge about the safety requirements and the electromagnetic compatibility (EMC). The planner has the responsibility to guarantee that the product or the final system comply to the pertinent regulations that are in force in the country in which the product (or the entire system) is used.

It's recommended to carefully select the conductors section, the fuses or other protection devices and the grounding connections.

ATTENTION

Before to make any intervention always disconnect the voltage supply through an approved isolation device and wait at least 10 minutes to be sure that the residual voltages will revert to the security levels.

NOTICE

The *iBMD-DC* system must be installed in an environment that guarantees the conditions that this manual prescribes (see [Section 2.8, Safety precautions and limits](#)), in particular it must be protected from excessive humidity and/or condensation. Furthermore it must be respect-

ed the maximum environment temperature (see [Chapter 6, Technical features](#)), considering that the heat that's produced by the system must be adequately dissipated in order to not exceed the maximum working temperature (see [Section 6.2, Power supply disposal and heat dissipation](#)). To ensure the maximum reliability of the system and of the related installation, the regular controls for the maintenance of the overwritten conditions must be done.

IMPORTANT

Pay particular attention on the input circuit wiring. The input voltages that have to be applied to the L1, L2 and L3 connectors ([X2 Power Line](#)) have to be connected to the power source with appropriate command and protection devices. Do not connect for any reason or error these voltages on other connectors, this will damage the power supply and it will be irreparable.

IMPORTANT

the device must be enclosed in a case so that to guarantee a pollution degree of 1 or 2.

IMPORTANT

Correctly connect the fuses and the power contactor on the power supply input. The power contactor command must have the RTO contact consent.

For the braking resistor wiring description see [Section 6.2, Power supply disposal and heat dissipation](#).

For the complete connection scheme see [Section 7.2.1, Complete connection scheme](#).

For the complete connection scheme of the RTO contact see [Section 6.7, RTO contact: Ready To Operate](#).

7.2. Electrical connections

The section about the electrical connection includes both the connectors pins and the characteristics and the description of the different parts which the system is made of; in particular the supply section, with the related limits, and the interface section (digital inputs and outputs, debug serial port).

⚠ NOTICE

A correct cable, ground and shield wiring is essential for the power supply safety and correct functioning. It's better if the cables are not interrupted; if it is not possible, be sure that the interruptions are reduced to the shortest possible length. It's recommended to always wire the cables without voltage presence.

⚠ NOTICE

In the device supply network electrical connections, the grounding conductor connection must be done so that this one is the last conductor to be interrupted in case of line interruption.

7.2.1. Complete connection scheme

ADVICE

Fix the input and output cables with cable ties, referring to the metal flange that are above or under the power supply.

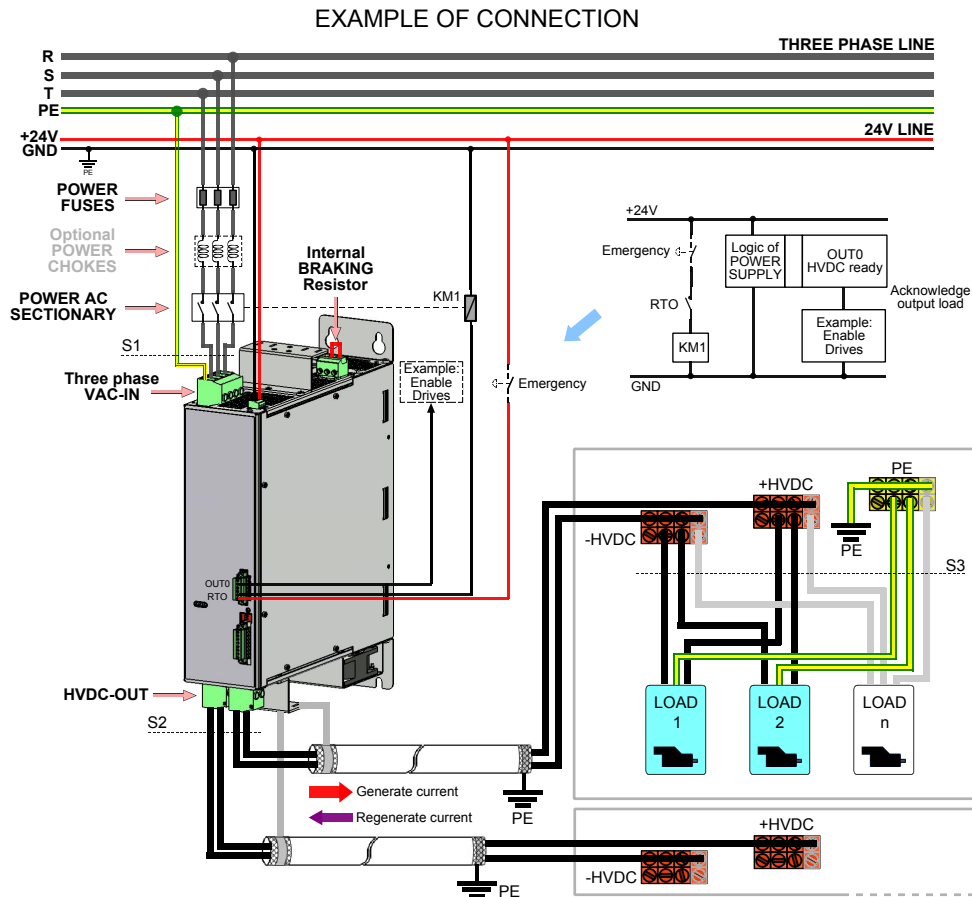


Figure 7.1. Connection scheme from line to load.

Minimal recommended conductors sections

ADVICE

The reported values have to be intended related to the **OutputCurrentLimit**, **CableCurrentLimit(CH1)** and **CableCurrentLimit(CH2)** parameters.

With the default current values:

Section	$i_{BMD-DC20}$ [mm ²]	$i_{BMD-DC40}$ [mm ²]
S1	4	10
S2	1,5	2,5

Section	iBMD-DC20 [mm ²]	iBMD-DC40 [mm ²]
S3	1,5	2,5

^aThe values are referred to the copper conductors insulated with PVC, to the C installation method, with 40°C environment temperature. For any other condition refer to the IEC 60364-5-52 standard.

Table 7.1. Minimal conductors section with default current values^a

With the maximum current values:

Section	iBMD-DC20 [mm ²]	iBMD-DC40 [mm ²]
S1	4	10
S2	4	4
S3	4	4

Table 7.2. Minimal conductors sections with maximum current values

⚠ NOTICE

The cables section must be adequate to the installed power (see [Table 7.1](#) and [Table 7.2](#)).

If the connection with the section that are reported in the table is not possible, use a protection for the conductors that does not interrupt the output voltage (no fuses).

7.2.2. Input section connection

The connector for the control section is [X3 Control supply](#), the one for the power section supply is [X2 Power Line](#).

In order to the safety, to a well functioning of the power supply and to a better behaviour against the noises, it's necessary to make the ground connection through a low impedance conductor (see [Grounding screw connection](#)). This conductor must be referred to the grounded equipotential collector of the machine.

There are no restrictions about the supply sequence: it can be provided the control voltage supply first and then the power one, and vice versa. But without the control section voltage the system doesn't turn on, therefore in this situation the leds don't light and it's not possible any communication (even if the power voltage is present). In the technical data table in the [Chapter 6, Technical features](#) there are the limits of the control and power sections voltage.

Connection notes

To connect the voltage supply use a cable with an adequate section (refer to the S1 group on the [Table 7.1](#) and the [Table 7.2](#)). The cable must be fixed through a cable tie, applied on the power supply superior bracket.

IMPORTANT

The power section is activated/deactivated by the contactor through the RTO contact. Check its correct connection. For further details see [Section 6.7, RTO contact: Ready To Operate](#).

⚠ ATTENTION

NEVER apply an alternate or a DC voltage out of the provided range or with an inverted polarity: this may cause damage on the power and/or control section and the risk of fire or electric arc.

⚠ ATTENTION

The power supply is provided of a control in case of overvoltage or undervoltage, so that the power supply is disabled if there are some supply problem, but this doesn't exclude to maintain the voltage between the limits, in particular in case of overvoltage.

⚠ ATTENTION

Refer the GND potential of the control supply to PE.

⚠ NOTICE

The control voltage supply must be guarantee "on the system connector level". Be sure that this range is respected in particular if a long cable is used (eventually compensate the voltage drop in the cable by giving a higher voltage upstream).

7.2.3. Output section connection

Two type of connections can be distinguished:

- Output channels separated connection
- Output channels parallel connection (for a correct parallel connection refer to the following picture)

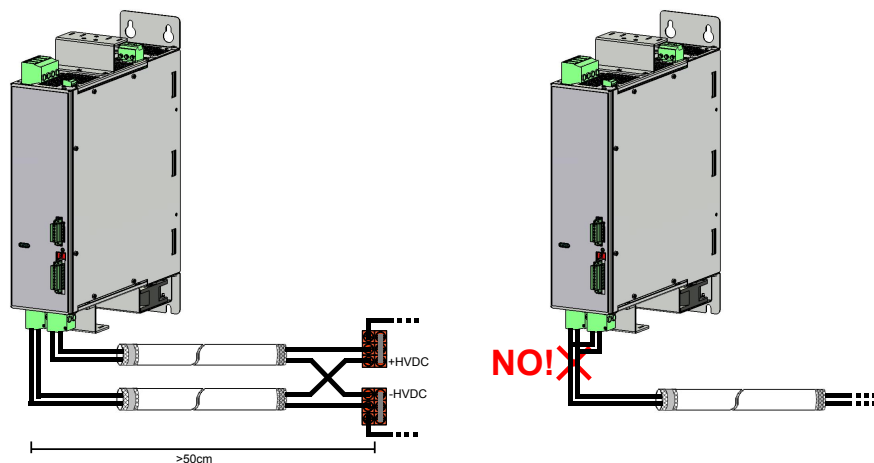


Figure 7.2. Output channels parallel connection

In particular, for both the connection type, even the cases with the shielded or not shielded cable can be considered:

- Connection with not shielded cable: when the cable length from the connector to the terminal board is not greater than 1 m.
- Connection with shielded cable: when the cable length from the connector to the terminal board is within 1 and 30m.¹

¹For length that are greater than 30 m, please contact Bonfiglioli Mechatronic Research S.p.a

Use a metallic ring appropriate to the selected cable diameter.

Connection notes

To connect the outputs use a cable with an adequate section (refer to the S2 group on the Table 7.1 and the Table 7.2). The cable must be fixed through a cable tie, applied on the power supply superior bracket. For the ring installation use the threaded holes that are present on the metallic inferior flange.



NEVER apply an alternate or a DC voltage to the output connectors: this may cause damage on the power and/or control section and the risk of fire or electric arc.

7.2.4. Wrong connections

Description	Scheme
<p><u>The network supply (TT or TN) is not insulated from PE ! (therefore it must be maintained an adequate electric isolation).</u></p> <p>The HVDC voltage provided on the iBMD-DC output is obtained from the network voltage through three-phase rectifier. (The + and - HVDC signals must not be connected to PE, or a short circuit may happen, and the diode bridge will be damaged).</p>	
<p>IT IS NOT ALLOWED THE PARALLEL CONNECTION OF ONE OR MORE iBMD-DC.</p> <p>All the return currents may, in unfavourable cases, concentrate and circulate in only one iBMD-DC (causing the overload fault) or even cause a permanent damage to the iBMD-DC, because it is traversed by the currents provided by the other/s iBMD-DC.</p>	

Table 7.3. Wrong connections schemes

7.2.5. Brake resistor



WARNING

BEFORE TO ACTIVATE THE POWER SUPPLY BE SURE THAT THE X1 Brake Resistor CONNECTOR (BRAKE RESISTOR) IS INSERTED AND CORRECTLY CONFIGURED. If the brake resistor is not sufficient or not present, there may be present overvoltage on the DC bus (HVDC) and, on consequence, the load that's connected on the output will be not correctly braked. THE NON-COMPLIANCE WITH THESE PRECAUTIONS CAN CAUSE MORTAL ACCIDENT, GRAVE INJURIES OR MATERIAL DAMAGES.

The default configuration provides the internal brake resistor presence through the pre-configuration of the connector X1 Brake Resistor. Do not remove the connector!

In general, it's possible to make the following configurations:

- Internal resistor (normal applications)
- Internal + external resistor (intermittent applications with high inertial loads)
- External resistor (continual applications with high inertial loads)

the [Figure 7.3](#) reports the braking resistor connection

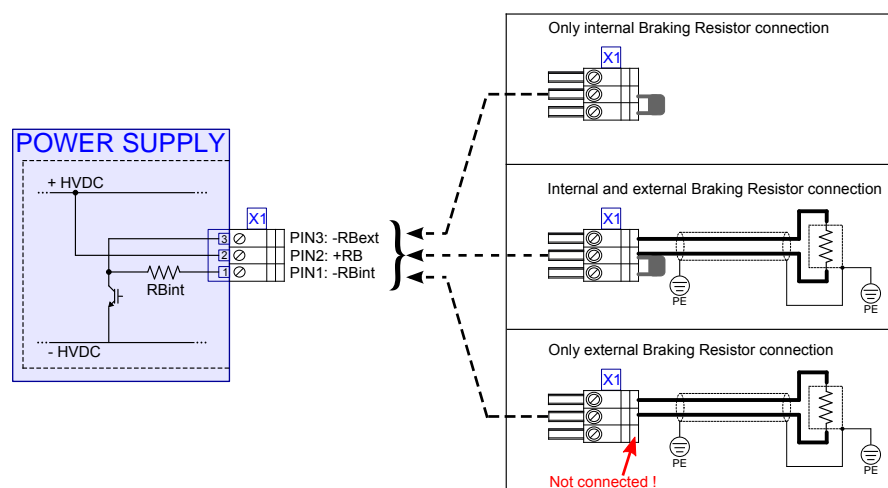


Figure 7.3. Braking resistor connection.



DANGER

For the braking resistor connection and(or configuration, interrupt the voltage supply on every connection (BOTH ON THE CONTROL AND THE POWER SECTIONS). Be aware that the voltage in the power connectors is lower enough not to provoke an electric shock. Check with a multimeter that the voltage between +HVDC and -HVDC (X7 e X8 Power Output) has decreased under 50Vdc.

WARNING

Do not disconnect the **X1 Brake Resistor** connector (RBRAKE) and any cable if the voltage supply is still present. There can be electric arcs that can damage the connector and the power supply and provoke a fire.



 DANGER

Very hot surfaces

- Depending on the functioning conditions, the braking resistor may reach temperature higher than 250°C.
- Avoid any contact with the brake resistor.
- Do not put near any flammable or sensitive to the heat components near the brake resistor.
- Provide an adequate heat dissipation.
- In the most critical cases, check the brake resistor temperature with a test working cycle.

The non-compliance with these precautions may provoke grave injuries or material damages.

7.2.6. Connectors

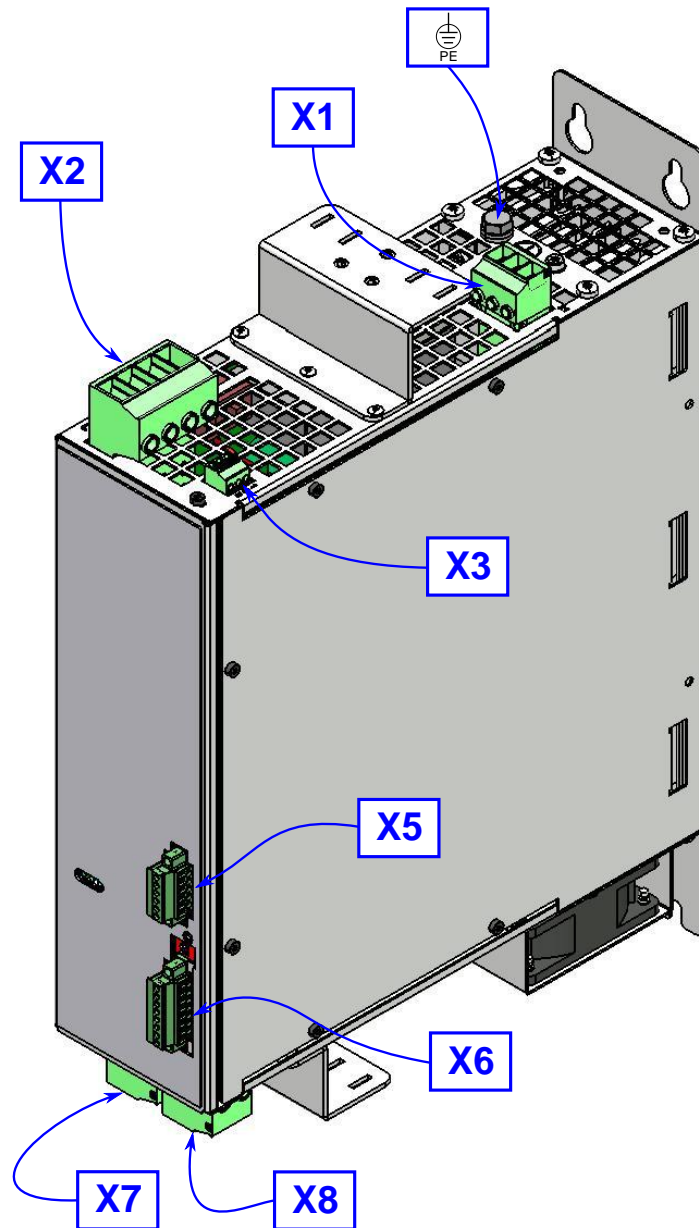


Figure 7.4. Connectors displacement.

NOTE

The connectors are prescribed for fixed conductors and thin cables. Stay within the maximum connection section. Keep in mind that the terminals increase the conductor section. Carefully insert the conductors to obtain the maximum ampere and the maximum vibration resistance.

Grounding screw connection

⚠ DANGER

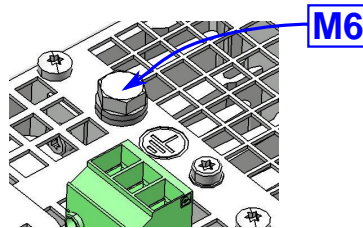
ELECTRIC SHOCK IN CASE OF INADEQUATE GROUNDING

This power supply presents a high dispersion current > 3,5mA.
 Use a protection conductor with minimum section of 10mm² (AWG 6) or two protection connectors with the same section of the power connectors section conductors. For the device grounding, respect the local regulations.

The non-compliance with this precaution may provoke grave injuries or death.

Screw for the connection with the common reference PE.

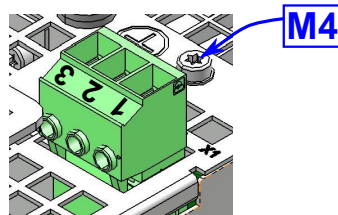
Screw M6		
Tightening torque	[Nm]	6



X1 Brake Resistor

Connector for the brake resistor and screw M4 for the grounding of the shield of the external resistor cable.

Phoenix PC 5/ 3-ST1-7,62 (1777736)		
Connector type	-	female extractable
Poles number	-	3
Connection section	[mm ²]	0,2 ÷ 6
Tightening torque	[Nm]	0,8



PIN	Diagram	Description
1	<p>Internal</p> <p>External</p>	In order to use the internal brake resistor, short circuit the pins 1 and 2.
2		In order to use the external brake resistor, connect it between the pins 2 and 3.
3		

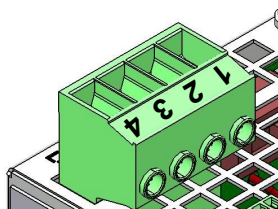
If an external resistor is connected, then connect the brake resistor cable shield to the screw M4, near the connector X1.

Screw M4		
Tightening torque	[Nm]	2

X2 Power Line

Connector for the three-phase supply.

Phoenix PC 16/ 4-ST-10,16 (1967391)		
Connector type	-	female extractable
Poles number	-	4
Connection section	[mm ²]	0,75 ÷ 16
Tightening torque	[Nm]	1,8



PIN	Signal	Description
1	L1	Line 1 of Three-phase source
2	L2	Line 2 of Three-phase source
3	L3	Line 3 of Three-phase source
4	PE	Functional earth

NOTE

This system presents a high dispersion current > 3,5mA. Refer to [Grounding screw connection](#).

X3 Control supply

Connector for the 24V control section supply.

Phoenix MC 1,5/ 3-ST-3,81 (1803581)		
Connector type	-	female extractable
Poles number	-	3
Connection section	[mm ²]	0,14 ÷ 1,5
Tightening torque	[Nm]	0,25



PIN	Signal	Description
1	+24V	+24Vdc Control Supply ^a
2	+24V	+24Vdc Control Supply ^a
3	GND	Ground Control Supply

^aThe pin 1 and 2 are internally connected, it's then sufficient to provide the 24V to one of them only.

X5 Input/Output

Connector for the digital inputs and outputs.

IMPORTANT

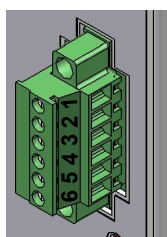
Be sure that the wiring, the cables and the connected interface accord to the PELV requirements.


Wurth Elektronik 3651-3,5mm series (691365110006)

Connector type	-	female extractable
Poles number	-	5
Connection section	[mm ²]	0,13 ÷ 1,5
Tightening torque	[Nm]	0,2

NOTE

The IN0 PNP digital input (24V) has the common ground internally connected to the system on the GND signal, that is the 24V supply ground present on **X3 Control supply-pin 3**. For this reason it's sufficient to connect on the inputs a signal which level is referred to this ground.



PIN	Signal	Description
1	IN0	Reset Fault
2	OUT0	HVDC Ready
3	OUT1	Vac Line State
4	OUT2	Fault
5	 RTO Contact	Section 6.7, RTO contact: Ready To Operate
6		

X6 COM port

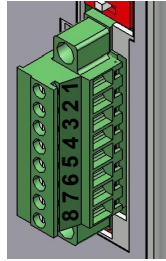
Connector for the communication with Modbus protocol on RS485.

Wurth Elektronik 3651-3,5mm series (691365110008)

Connector type	-	female extractable
Poles number	-	8
Connection section	[mm ²]	0,13 ÷ 1,5
Tightening torque	[Nm]	0,2

IMPORTANT

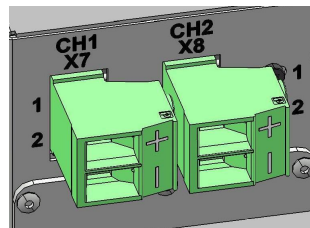
This serial port is isolated. The cable shield must be connected to the earth on the host side (PC) and to the pin 8 on the power supply side.



PIN	Signal	Description										
1	-	Not connected										
2	-	Not connected										
3	<table border="0"> <tr> <td colspan="2" style="text-align: center;">COM SELECTION</td> </tr> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">3- NC</td> </tr> <tr> <td style="text-align: center;">4</td> <td style="text-align: center;">4- NC</td> </tr> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">RS232</td> </tr> <tr> <td style="text-align: center;">4</td> <td style="text-align: center;">RS485</td> </tr> </table>	COM SELECTION		3	3- NC	4	4- NC	3	RS232	4	RS485	short circuit = RS232, open circuit = Not implemented
COM SELECTION												
3	3- NC											
4	4- NC											
3	RS232											
4	RS485											
5	GND_COM	Ground RS232										
6	TX232	Transmit Data RS232										
7	RX232	Receive Data RS232										
8	SHIELD	Shield										

X7 and X8 Power Output HVDC output connectors.

Phoenix IPC16/2-ST-10,16 (1969373)		
Connector type	-	female extractable
Poles number	-	2
Connection section	[mm ²]	0,75 ÷ 16
Tightening torque	[Nm]	1,8



PIN	Signal	Description
1	+HVDC	+HVDC Power Output
2	-HVDC	-HVDC Power Output

7.3. Leds

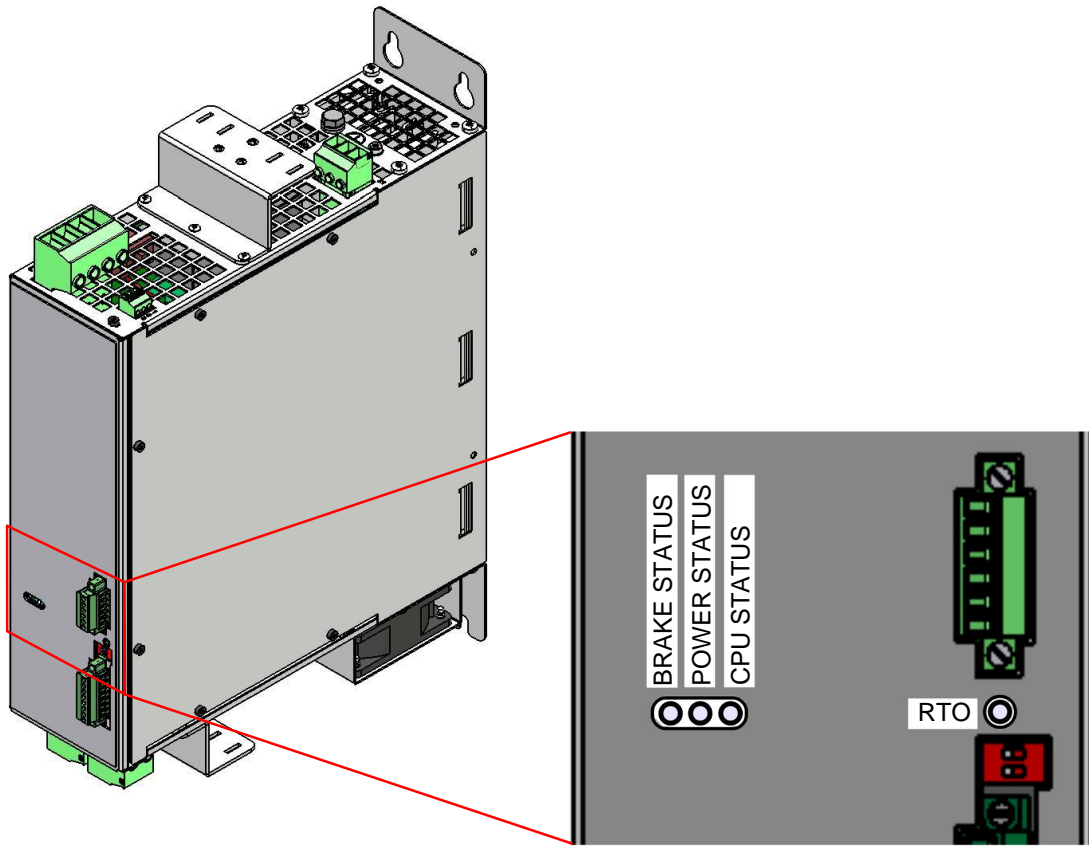


Figure 7.5. leds and dip switches disposal.

The leds can have the following statuses:

- *OFF*: led switched off;
- *ON*: fixed led switched on;
- *BLK* (blinking): led 200 ms on, 200 ms off;

The notifications meaning, shown through the leds, can be found in the following table:

Leds	Colour	Status	Meaning
RTO CONTACT STATUS	-	OFF	Open contact
	GREEN	ON	Closed contact
CPU STATUS	-	OFF	CPU not working (check Control Voltage)
	GREEN	ON	CPU working in firmware mode
	ORANGE	ON	CPU working in boot mode
	RED	ON	CPU in reset
POWER STATUS	-	OFF	Power supply off or in boot
	GREEN	FLASH	Start-up sequence (voltage/current monitor)
	GREEN	ON	Power supply operative, output current <70% Inom. (no warning and fault)
	GREEN and ORANGE	ON	Power supply operative, output current ≥70% Inom (no warning and fault)

Leds	Colour	Status	Meaning
	ORANGE	ON	Power supply in warning, power section is working (one or more active warning)
	RED	ON	Power supply in fault, power section is not working (one or more active fault)
BRAKE STATUS	-	OFF	Brake not active
	ORANGE	ON	Brake active (energy < 50% of the maximum tolerable)
	RED	ON	Brake active (energy ≥ 50% of the maximum tolerable)

Table 7.4. Description of the leds for iBMD-DC.

7.4. Dip switches

Grounding Capacitor Switch

This power supply contains a filter that decreases the noises and is connected to the ground through a capacitor. The slide switch SW1 allows to disconnect the capacitor and then to reduce the eventual current dispersion to earth and the load on the same capacitor.

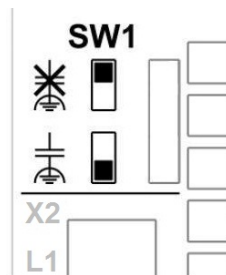


Figure 7.6. Dip switch SW1 disposal.

⚠ ATTENTION

The capacitor disconnection implies a non-compliance to the EMC standards. In any case always cut the line voltage before to operate on SW1.

NOTE

The default position of SW1 is with the capacitor connected to the ground.

Chapter 8

Power supply logical states

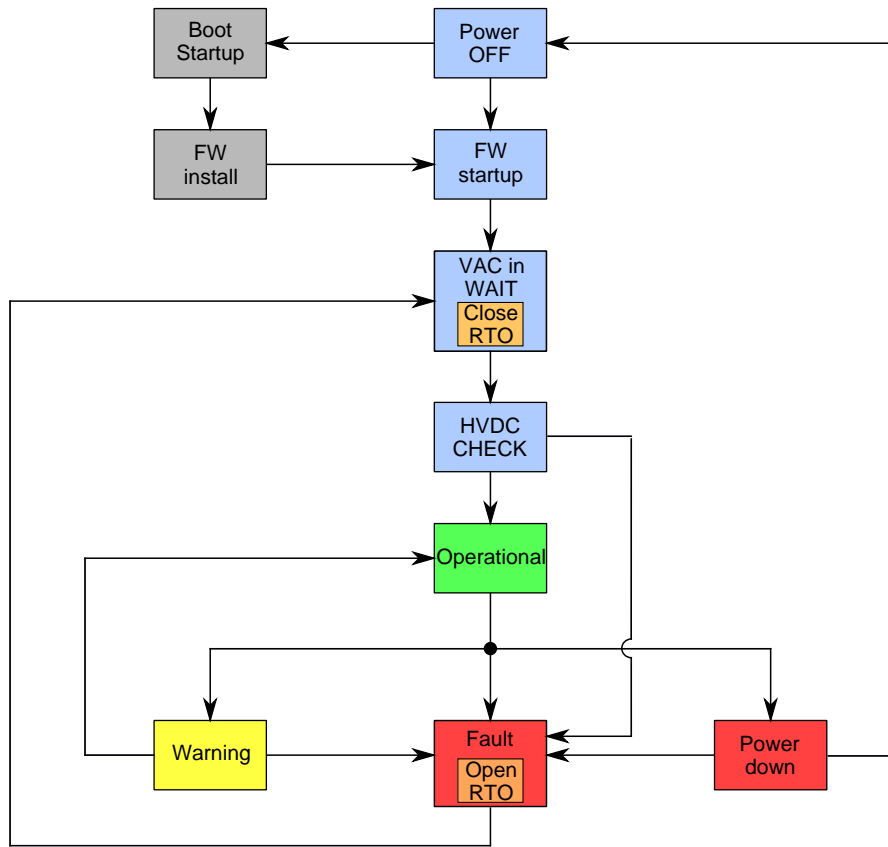


Figure 8.1. Logical states diagram.

Status	Value DeviceStatus	Description
Power OFF	-	Control section 24Volt supply missing, through the hardware circuit the RTO contact is kept disabled
Boot Start-up	-	24V supply present, boot start-up to fill a firmware anomaly (corrupted firmware or hardware and boot incompatibility)
FW Install	-	Updating the firmware through the debug serial port
FW Start-up	0	24 Volt supply present, firmware start-up
	1	24 Volt supply present, system auto-test, capacitor discharge
	2	24 Volt supply present, measurement circuit calibration
VAC in WAIT	3	The RTO contact is closed and the VAC input voltage is controlled, the next status is reached only if an input voltage included in the functioning limits is detected, otherwise the VAC in WAIT status remains
HVDC CHECK	4	The output voltage trend is analyzed: within the capacitors charging time the voltage must grow until a value within VOUT_MIN and VOUT_MAX.
	5	The output voltage trend is analyzed: ripple must be lower than a safety threshold. At the end of this phase, if all the parameters are within the limits, the system is in normal functioning conditions and the device switches to the Operative Status, otherwise it switches to the Fault Status
Operational	6	The power supply works normally, no warnings or faults are detected, the input voltage is present
	7	The power supply works normally, no warnings or faults are detected, the input voltage is not present

Status	Value DeviceStatus	Description
Warning	8	The power supply works normally, but some parameter has exceeded the warning threshold (voltage/current/temperature)
Fault	9	The power supply is in this status when one of the type of the monitored faults happens, so the RTO contact is opened and the timer of Fault restore waiting starts. When the restore waiting time is elapsed it is verified if the fault is solved, and in this case the power supply returns in the VAC in WAIT status, according to the available restore sources (INO input, automatic restore, restore via software with MotionDrive); otherwise the Fault status remains.
Power down	10	The power supply is in this status when the 24Vdc voltage fall down below 18Vdc, in this case the RTO contact is opened. If the voltage supply restores, the power supply switches to the "NO 24V IN" status and returns the Input voltage missing on control section fault

Table 8.1. Power supply logical states description.

Chapter 9

*i*BMD-DC parametrization

9.1. Limits that can be set by the user

Here follows the list of the limits that can be set by the user, pay attention that the device has even fixed limits: see [Table 6.6](#)

Parameter name	Description	Default		Range	
		<i>i</i> BMD-DC20	<i>i</i> BMD-DC40	<i>i</i> BMD-DC20	<i>i</i> BMD-DC40
OutputCurrentLimit	Total positive current CH1+CH2 (outgoing)	20 A	40 A	1 ÷ 20 A	1 ÷ 40 A
CableCurrentLimit(CH1)	RMS current on CH1	10 A	20 A	1 ÷ 25 A	1 ÷ 25 A
CableCurrentLimit(CH2)	RMS current on CH2	10 A	20 A	1 ÷ 25 A	1 ÷ 25 A
OvervoltageLimit	Once this value is reached the <i>i</i> BMD-DC immediately switches in fault	830 V		100 ÷ 830 V	
BrakingCircuitActivation-Voltage	Once this value is reached the brake circuit is activated and the voltage increasing is limited	785 V		100 ÷ 785 V	

Table 9.1. Limits that can be set by the user related to the output section

The **CableCurrentLimit(CH1)** and **CableCurrentLimit(CH2)** parameters are independent each other, and their value must be adequate to the section of the cables that are connected to the outputs. The **OutputCurrentLimit** parameter determines the maximum value of the total output current, but it doesn't affect on the current limit values that can be set on each single output.

OutputCurrentLimit

This parameter refers to the **RMS_OutputCurrent**.

When **RMS_OutputCurrent** > **OutputCurrentLimit** the **DeviceEnergyOverloadPercentage** variable increases and when it reaches the 100% the fault intervenes : **Device energy overload exceeds the limit**.

The intervention time is obtained from the I^2T internal calculation, in particular it takes the value of 5sec when the following conditions occur: line 400Vac, **RMS_OutputCurrent** equal to $2 * \text{OutputCurrentLimit}$.

CableCurrentLimit(CH1)

This parameter refers to the **RMS_CurrentCH1**.

When **RMS_CurrentCH1** > $1,3 * \text{CableCurrentLimit(CH1)}$ the **CableEnergyOverloadPercentageCH1** variable increases and when it reaches the 100% the fault intervenes : **Cable energy overload exceeds the limit on channel 1**.

The intervention time is obtained from the I^2T internal calculation, in particular it takes the value of 3600sec (1 hour) when the following conditions occur: line 400Vac, **RMS_CurrentCH1** equal to $1,3 * \text{CableCurrentLimit(CH1)}$.

CableCurrentLimit(CH2)

This parameter refers to the **RMS_CurrentCH2**.

When **RMS_CurrentCH2** > $1,3 * \text{CableCurrentLimit(CH2)}$ the **CableEnergyOverloadPercentageCH2** variable increases and when it reaches the 100% the fault intervenes : **Cable energy overload exceeds the limit on channel 2**.

The intervention time is obtained from the I^2T internal calculation, in particular it takes the value of 3600sec (1 hour) when the following conditions occur: line 400Vac, **RMS_CurrentCH2** equal to $1,3 * \text{CableCurrentLimit(CH2)}$.

OvervoltageLimit

This parameter refers to the **HVDC_OutputVoltage**.

When **HVDC_OutputVoltage** > **OvervoltageLimit** the fault status activates: **Overvoltage of power section**.

BrakingCircuitActivationVoltage

This parameter refers to the **HVDC_OutputVoltage**.

When **HVDC_OutputVoltage** > **BrakingCircuitActivationVoltage** the Brake Circuit activates to limit the **HVDC_OutputVoltage**. Consequently, if the power that is absorbed by the Brake Circuit is greater than the **IntBrakeResistorNominalPower** or the **ExtBrakeResistorNomi-**

nalPower, the BrakeEnergyOverloadPercentage variable increases and when it reaches the 100% the fault status activates: **Braking circuit energy overload exceeds the limit.**

RMS_Average_CalculationPeriod

It is applied to all the RMS, AVG variables of CH1, CH2 and total. An example of RMS and AVG variables is the following: RMS current, RMS output current, RMS back-feeding current, AVG current, AVG power referred to both CH1 and CH2.

Summary

The following table summarizes the description of the user parameters above described. The *reference variable* value variation determines the *increment variable* value variation (when it's present, otherwise the comparison is made with the same reference variable). When this one exceeds the set limit value (*User parameter*) the system enters in the related *fault* status.

Reference variable	User parameter	Increment variable	Fault
RMS_OutputCurrent	OutputCurrentLimit	DeviceEnergyOverloadPercentage	Device energy overload exceeds the limit
RMS_CurrentCH1	CableCurrentLimit(CH1)	CableEnergyOverloadPercentageCH1	Cable energy overload exceeds the limit on channel 1
RMS_CurrentCH2	CableCurrentLimit(CH2)	CableEnergyOverloadPercentageCH2	Cable energy overload exceeds the limit on channel 2
HVDC_OutputVoltage	OvervoltageLimit	-	Overvoltage of power section
HVDC_OutputVoltage	BrakingCircuitActivationVoltage	BrakeEnergyOverloadPercentage	Braking circuit energy overload exceeds the limit
-	RMS_Average_CalculationPeriod	-	-

Chapter 10

Fault and warning

The *i*BMD-DC power supply provides some monitor functions of its physical quantities (voltage, current, temperature, etc.) in order to check the correct functioning of the power supply itself and to protect the electronic devices that are connected to it. If a functioning limit exceeding is detected, the power supply switches to the Fault status and opens the RTO contact, in order to cut off the VAC IN power supply. The fault status signal is indicated by the POWER STATUS led, when it's on and red (see [Section 7.3, "Leds"](#)), through MotionDrive it's possible to know the Fault that is occurred in order to execute the right corrective action.

The *i*BMD-DC power supply, when detects some malfunctioning anomalies or some parameters setting error, signals the error. The errors are divided in two categories, depending on their severity level:

- **Warning:** error that indicates a non grave condition of the power supply
- **Fault:** error that prevents and interrupts the power supply on the power section through the RTO contact opening;

In general, when the power supply is in the Operative or Warning status, all the physical quantities are monitored (voltage, current, temperature, etc.) and if one of them exceeds the functioning limits, the power supply switches to the Fault status.

Furthermore, the errors can be:

- **Dynamic:** the error condition is still present in the power supply
- **Retentive:** the error is memorized by the power supply until it's reset (so the error cause can be no more present).

NOTE

The default configuration about the FAULT is retentive.

**⚠ DANGER**

In case of maintenance, be sure that the input voltages of the power supply are deactivated. Then check with a multimeter that the voltage between +HVDC and -HVDC has decreased under 50Vdc.

⚠ NOTICE

The only retentive faults exception is the HVDC undervoltage with alternate voltage missing on the power supply input (VAC_IN). In this case an automatic restart is done.

The HVDC voltage decreasing on the output may generate the **Undervoltage of power section** fault that implies the RTO contact closing and the VAC_IN input voltage check. The next status (start-up) will be reached only if an input voltage within the functioning limits is detected, otherwise it remains in the VAC IN WAIT status. **Undervoltage of power section** will be automatically reset when the voltage will be once again present.

If the fault intervenes when the input alternate current (VAC_IN) is present it will not be possible the automatic reset.

10.1. Faults reaction

When the power supply is in the Operational, Warning and HVDC CHECK statuses, all the physical quantities are monitored, and if at least one of them exceeds the functioning limits, then the Fault status is reached.

Referring to the [Table 10.1](#), the great part of the faults are retentive and therefore need a reset procedure (see [Section 10.2](#), “*Errors reset*”).

The only exception regards the only non blocking fault, the **Input voltage missing on power section** fault, that is not retentive, but only dynamic. This means that if the power section input voltage is missing, the system switches to FAULT; when the voltage is restored the warning signaling remains but it is not blocking, therefore it will occur a new start-up.

In the Fault condition, the power supply disables the RTO contact (see [Section 6.7](#), “*RTO contact: Ready To Operate*”), continues to check all the physical quantities and extends the Fault status until at least one of the faults, that are listed below, is present. Since no one of the fault conditions is present, the restore waiting time starts ([FaultLockTime](#)).

In the following table there are reported the WD, WR, FD and FR abbreviations, that assume the following meaning:

- WD: main dynamic warnings
- WR: main retentive warnings
- FD: main dynamic faults
- FR: main retentive faults

Fault type	FaultLock-Time (s)	Fault Code	WD	WR	FD	FR
Undervoltage of power section	5	1	-	-	YES	YES

Fault type	FaultLock-Time (s)	Fault Code	WD	WR	FD	FR
Overvoltage of power section	5	2	-	-	YES	YES
Voltage ripple exceeds the limit on power section	10	3	-	-	YES	YES
Overtemperature of control section	10	4	YES	YES	YES	YES
Overtemperature of power section	10	5	YES	YES	YES	YES
Overcurrent of power section	10	6	-	-	YES	YES
Device energy overload exceeds the limit	10	7	YES	YES	YES	YES
Braking circuit energy overload exceeds the limit	10	8	YES	YES	YES	YES
Overvoltage of HVDC output during braking	-	-	YES	YES	-	-
Input voltage missing on power section	9	-	-	YES	YES	
Short circuit on braking circuit	10	10	-	-	YES	YES
Input voltage missing on control section	0.1	11	-	-	YES	YES
Charge circuit energy overload	100	12	-	-	YES	YES
Configuration parameters missing	-	13	-	-	YES	YES
Device energy overload exceeds the limit on channel 1	10	16	YES	YES	YES	YES
Device energy overload exceeds the limit on channel 2	10	17	YES	YES	YES	YES
Internal circuit ripple exceeds the limit on power section	10	18	-	-	YES	YES
Input voltage falling on power section	5	19	-	-	YES	YES
Cable energy overload exceeds the limit on channel 1	100	21	YES	YES	YES	YES
Cable energy overload exceeds the limit on channel 2	100	22	YES	YES	YES	YES
Hardware configuration not valid	10	20	-	-	YES	YES

Table 10.1. Faults list: related codes and restore times.

ADVICE

For the details and the solutions of the faults please see [Section 10.3, “Errors description”](#)

10.2. Errors reset

The restore of the power supply from the Fault status can be made in 3 different ways, in any case there must be no more active faults and the longer **FaultLockTime** between the detected faults must be elapsed (see [Table 10.1](#)).

The modes are:

- Automatic restart: if the **AutomaticRestartFunction** parameter is set to 1 the power supply automatically returns in the VAC IN WAIT state
- restore through IN0: if a positive transition is detected on the IN0 input, the power supply returns in the VAC IN WAIT state
- restore from MotionDrive: by pushing the Reset Errors button, the power supply returns in the VAC IN WAIT state

NOTICE

If the 24V IN control side voltage is cut off, then the fault signals are lost and the power supply may normally restart even before the **FaultLockTime** time is elapsed (see [Table 10.1](#)).

**WE ADVISE AGAINST THIS PROCEDURE IN ORDER TO
AVOID RISKS OF INTERNAL COMPONENTS DAMAGE.**

Necessary conditions to execute the faults reset

In order to reset the faults, the following points must be verified:

- restore time waiting ([FaultLockTime](#) see [Table 10.1](#)).
- Accumulated over energy discharge waiting (only for the faults that are reported in [Table 10.2](#))

In the first case if the control section turns off the restore time is immediately reset, so at the next power on and without faults it's possible a new immediate start-up of the power supply. Wait in any case the restoring time in order to avoid risk of internal components irreparable damages.

Instead, in the second case, if the control section is turned off the energy that has been accumulated until that moment, is memorized so, at the following turn on, the previous energy is returned and a warning ($50\% < \text{overload} < 100\%$) or a fault ($\text{overload} \geq 100\%$) is reported.

Even after a fault, keep on the control section in order to allow the accumulated energy discharge and so maintain the alignment between the theoretical energy and the real one, related to the circuit that has to be protected.

Fault	1% discharge time	100% discharge time	Energy memorization on the 24V turn off
Braking circuit energy overload exceeds the limit	0,5s	50s	YES
Charge circuit energy overload	0,5s	50s	YES
Cable energy overload exceeds the limit on channel 1	24,8s	2480s	YES
Cable energy overload exceeds the limit on channel 2	24,8s	2480s	YES
Device energy overload exceeds the limit	0,15s	15s	-
Device energy overload exceeds the limit on channel 1	0,18s	18s	-
Device energy overload exceeds the limit on channel 2	0,18s	18s	-

Table 10.2. Accumulated energy discharge time estimation.

10.3. Errors description

Here follows the list of the faults that are managed (see [Table 10.1](#)) and the corrective action to perform.

NOTE

About the data related to the functioning ranges, temperature, etc. refer to [Chapter 6, Technical features](#).

Undervoltage of power section

HVDC effective voltage lower than the minimum limit.

Check that the input voltage (VAC_IN) is within the expected functioning range, that there is no voltage difference between the phases and there are no voltage dips.

Overvoltage of power section

HVDC effective voltage higher than the minimum limit.

Check that the input voltage (VAC_IN) is within the expected functioning range, and check if the overvoltage is due to the regeneration current of the connected drives.

Voltage ripple exceeds the limit on power section

Voltage ripple higher than the 25 % of the nominal voltage for 700 ms.

Check that the input voltage (VAC_IN) is three-phase and within the expected functioning range and there are no voltage dips (if one of the three phases is missing and a load is present on the output a higher ripple effects on HVDC are produced, and they may activate this fault); check if there are overload conditions on the output line (HVDC).

Overtemperature of control section

Temperature of the control section higher than the maximum limit.

Check the power supply environment temperature and its correct positioning and ventilation inside the electrical panel.

Overtemperature of power section

Temperature of the power section higher than the maximum limit.

Check the power supply environment temperature and its correct positioning and ventilation inside the electrical panel. Furthermore, check the BRAKE circuit intervention frequency if it has been configured the internal brake resistor use (Internal brake circuit) (see [Section 6.6, Brake resistor](#)).

Overcurrent of power section

Instantaneous current higher than the maximum limit.

Check the output current and the eventual peaks.

Device energy overload exceeds the limit

Energy provided by the power supply higher than the maximum value.

Check that the [RMS_OutputCurrent](#) is not higher than the [OutputCurrentLimit](#).

Braking circuit energy overload exceeds the limit

Energy absorbed by the overvoltage protection circuit higher than the maximum value.

Check the BRAKE circuit intervention frequency (see [Section 6.6, Brake resistor](#)), check if the Brake switch on threshold parameter has been set with a too low value ([BrakingCircuitActivationVoltage](#)).

Overvoltage of HVDC output during braking

The output voltage exceeds by 15V the *Maximum activation threshold* of the Braking Circuit.

Check the braking resistor value or decrease the motors braking dynamic (deceleration ramps).

Input voltage missing on power section

Power section input voltage missing.

Check the RTO contact ([Section 6.7, RTO contact: Ready To Operate](#)) and the power relay activation, check the upstream supply of the power relay and the status of eventual fuses, disconnecting switches.

Short circuit on braking circuit

Short circuit detected in the Brake protection section.

Check the connector [X1 Brake Resistor](#) (connection of the external resistor, check even its value).

Input voltage missing on control section

Control section voltage supply missing (< 18 Vdc).

Check if the 24V supply on [X3 Control supply](#) is within the correct range and that there are no voltage dips during the functioning.

Charge circuit energy overload

The energy absorbed by the capacitor charging current limitation circuit is higher than the maximum value (see [Table 6.7](#)).

Check that at the start-up there are no loads on the output connectors [X7 e X8 Power Output](#) (the output load during this operation must mainly be capacitive).

Configuration parameters missing

Missing or corrupted configuration parameters, it's not possible to use the power supply because the set of the parameters that characterize it is not valid and can't be restored by the user.

Send back to repair, please contact Bonfiglioli Mechatronic Research S.p.a

Device energy overload exceeds the limit on channel 1

Energy provided in the CH1 channel higher than the maximum value.

Check that the [RMS_CurrentCH1](#) is within the range ([Table 6.6](#)).

Device energy overload exceeds the limit on channel 2

Energy provided in the CH2 channel higher than the maximum value.

Check that the [RMS_CurrentCH2](#) is within the range ([Table 6.6](#)).

Internal circuit ripple exceeds the limit on power section

During the start-up, the output voltage difference (ripple) between VBRIDGE (HVDC nominal value) and the actual value of HVDC is higher than 50V (see [Section 6.5.1, “Charge circuit functioning”](#)).

Check that at the start-up there are no excessive loads on the output connectors [X7 e X8 Power Output](#).

Input voltage falling on power section

Input voltage dip for more than 20 ms and HVDC output voltage value lower than the 65% of the nominal voltage.

Check the VAC_IN input alternate voltage, the wiring and the protection upstream of the power supply.

Cable energy overload exceeds the limit on channel 1

Protection energy of the cable connected to X7 (CH1) higher than the maximum value (see [X7 e X8 Power Output](#)).

Check that [RMS_CurrentCH1](#) is within the limit [CableCurrentLimit\(CH1\)](#). Check that the value that is set on Cable current limit (see [Table 9.1](#)) is not too low. If it will be necessary to increase its value, check the dimensioning of the cable (section, length, ...) to avoid the overheating.

Cable energy overload exceeds the limit on channel 2

Protection energy of the cable connected to X8 (CH2) higher than the maximum value (see [X7 e X8 Power Output](#)).

Check that [RMS_CurrentCH2](#) is within the limit [CableCurrentLimit\(CH2\)](#). Check that the value that is set on Cable current limit (see [Table 9.1](#)) is not too low. If it will be necessary to increase its value, check the dimensioning of the cable (section, length, ...) to avoid the overheating.

Hardware configuration not valid

Hardware configuration not valid.

Send back to repair, please contact Bonfiglioli Mechatronic Research S.p.a

10.4. Errors in parameters reading / writing

When a parameter reading / writing error occurs, to understand the problem it's necessary to get the error code.

- auxiliary communication port: the error code of the last failed access is reported in [AuxiliaryPortErrorCode](#);

Auxiliary-PortErrorCode	Error	Description
0x00	No error	No error.

Auxiliary-PortErrorCode	Error	Description
0x01	Modbus protocol error: illegal function	Modbus function code not supported. In Table 4.1 the admitted codes are listed.
0x02	Modbus protocol error: address not existent	Address not existent: the combination of the Modbus address and the number of data to be read / write is not valid; the addresses that are included in the required range must be present in the object dictionary.
0x03	Modbus protocol error: data dimension too large	Quantity of data not admitted: it's too high or equal to 0.
0x10	Modbus protocol error: illegal upload/download code	Upload/download code not valid.
0x11	Modbus protocol error: unexpected upload/download state	Upload/download status not expected.
0x12	Modbus protocol error initializing upload/download	Upload/download wrong initialization.
0x13	Modbus protocol error during upload/download	Error during the data upload/download.
0x14	Modbus protocol error closing upload/download	Error during the upload/download closing.
0x15	Modbus protocol error: memory overflow during upload/download	Insufficient memory to complete the upload/download.
0x16	Unexpected toggle bit	Toggle bit not alternated during the upload/download.
0x20	Memory not available	Insufficient memory to execute the required operation.
0x21	Access denied	Access denied to the parameter.
0x22	Attempt to read a write only object	Reading failed, the parameter can only be written.
0x23	Attempt to write a read only object	Writing failed, the parameter can only be readed.
0x24	General parameter incompatibility	Generic data incompatibility.
0x25	General internal incompatibility	Generic incompatibility, internal of the power supply.
0x26	Hardware error	Access failed due to a hardware error.
0x28	Parameter out of range	Parameter value out of the admitted range.
0x29	Generic error	Generic error.
0x2A	Internal control refuse data	Access denied because of a local control.
0x2B	Internal state refuse data	Access denied because of the actual power supply status.

Table 10.3. Coding of the parameters reading / writing error codes.

Chapter 11

Software updating

11.1. Firmware updating

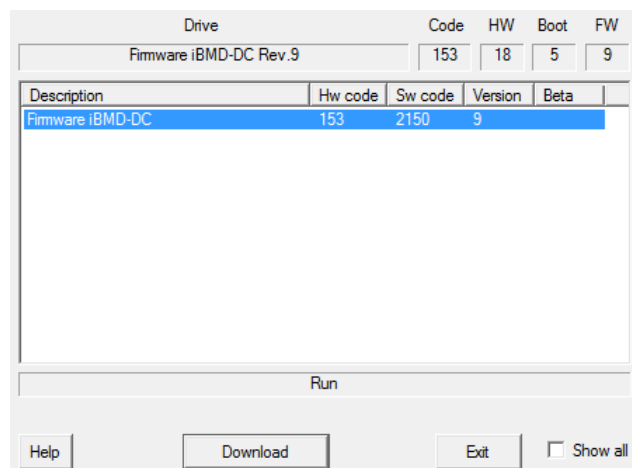
IMPORTANT


The firmware updating does not cancel any data saved in the permanent memory.

To update the firmware, connect the power supply with MotionDrive and open the Download firmware window. Access with MotionDrive:

Main menu > Supply > Download firmware ...

Toolbar > 



In the Download firmware window, choose the desired firmware and press . If the firmware does not appear in the proposed list, update the Configuration files.

ADVICE

If at the end of the download, the firmware does not start up, check what reported in the window and in the parameter in [FirmwareStatus](#).

11.2. Updating the boot

NOTICE

If during the boot updating the control section runs out of power, the power supply cannot be used anymore and must be sent back to Bonfiglioli Mechatronic Research S.p.a. During the updating, supply power to the power supply with an uninterruptible power supply (UPS).

To update the boot, connect the power supply with MotionDrive and open the Download firmware window.

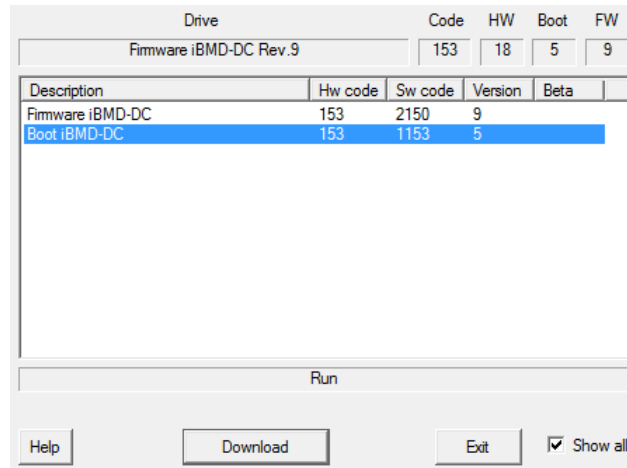
IMPORTANT

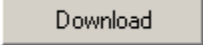
Update the boot software only if really necessary.

Access with MotionDrive:

Main menu > Supply > Download firmware ...

Toolbar > 



Activate the Show all option in the download firmware window, select the desired boot and push . If the boot does not appear in the proposed list, update the Configuration files.

NOTE

After downloading the boot it is necessary to download the firmware again. The data saved in the permanent memory are not cancelled.

11.3. Updating the Configuration File

The Configuration files are files xml used by MotionDrive to communicate with the power supply. Their update is included in the MotionDrive installation. In order to install the last available version of MotionDrive that contains the most updated Configuration Files, follow the instructions that are contained in the [Section 3.2, "Installation"](#).

Chapter 12

Object dictionary

IMPORTANT

The parameters that are described in this chapter refers to the version of firmware and hardware as reported at the beginning of the [Chapter 1, General informations about this manual](#).

The exchange of data with the power supply takes place through a list of parameters, called *Object dictionary*. The parameters define and control each single function of the power supply.

12.1. Agreements on the parameters description

Every power supply parameter is described in this chapter by the fields in the following table:

Field	Description
<i>All</i>	The written " <i>Desc</i> ", in whatever box is inserted, means that the field information can be found in the following description.
Modbus	Parameter address which is accessible through protocol Modbus. The number is expressed on a decimal basis.
CANopen	Parameter address which is accessible through protocol CANopen ^a .
Range	Range of values accepted for the parameter. If it is not specified it means that all values represented by the type of datum associated to the parameter are considered as valid.

Field	Description
Default	Parameter default value.
Type	Type of datum associated to the parameter: <ul style="list-style-type: none"> • U8: 8 bits without sign • U16: 16 bits without sign; • U32: 32 bits without sign; • S8: 8 bits with sign; • S16: 16 bits with sign; • S32: 32 bits with sign; • STR: string; • IQN: notation at fixed point at 32 bits with sign and N bits after the point; • FLT: floating point single precision.
Units	Units of measurement of the parameter.
Acc	Type of access to the parameter: <ul style="list-style-type: none"> • RW (read/write): reading and writing; • WO (write only): only writing; • RO (read only): only reading; • CST (constant): only reading (constant parameter).
PDO	This voice is related only to the CANopen protocol, that is actually not implemented.
Mem	Type of parameter saving in the permanent memory: <ul style="list-style-type: none"> • -: parameters non savable in the permanent memory • ES: parameters savable in the permanent memory that cannot be restored on command with the default values; • EM: parameters savable in the permanent memory that are not restored on command with default values.

^aThe CANopen protocol is actually not implemented.

Table 12.1. Fields describing the parameters

12.2. Reading and writing a parameter

The dimension of every **Modbus register** is 1 Word (2 byte). Therefore each parameter takes a minimum of 2 bytes of memory. For example:

- if a parameter is 8 bit long (1 byte = 1/2 Word) it takes 1 word anyway, therefore if it is on 4100 Modbus address, the next parameter is on 4101;

- if a parameter is 16 bit long (2 byte = 1 Word) it takes 1 word, therefore if it is on 1201 Modbus address, the next parameter is on 1202;

- if a parameter is 32 bit long (4 byte = 2 Word) it takes 2 words, therefore if it is on 4110 Modbus address, the contained data take even the 4111 register and, in consequence, the next parameter is on 4112;

NOTE

To read and write a parameter via Modbus, send a frame by using the function codes written in [Table 4.1](#).

To select the parameter to read or write in the window Object dictionary, you can click on the proposed list, write the name and the address or use the search by name functions in the box Filter (for details about the dictionary interface use, refer to [Section 3.7, Object dictionary](#)).

ADVICE

To interpret any error messages please see [Section 10.4, Errors in parameters reading / writing.](#)

12.3. Initial configuration, update and board identity (0-599)

DeviceInformation

Informations related to the device.

Number of entries

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
-	-	6	6	U8	-	CST	-	-

Number of parameters in this group.

HardwareRevision

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
12	-	-	-	S16	-	RO	-	-

Device hardware revision.

BootRevision

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
15	-	-	-	S16	-	RO	-	-

Boot firmware revision.

FirmwareRevision

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
18	-	-	-	S16	-	RO	-	-

Firmware revision. If the value is -1, only the boot firmware is present.

HardwareProductCode

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
21	-	-	-	U32	-	RO	-	-

Device hardware code.

OemCode

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
33	-	6873	6873	U16	-	CST	-	-

Code that identifies the manufacturer.

SoftwareProductCode

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
34	-	-	-	U16	-	RO	-	-

Device software code.

FirmwareStatus

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
40	-	-	-	U8	-	RO	-	-

Firmware status.

FirmwareStatus	Message	Solution
0	CRC has not been checked yet	Wait the end of the download procedure.
1	Do not launch firmware	
10	Run	Firmware is executing.
11	Permanent memory error	Error in the permanent memory, turn off and on again the device. If the problem persists, please contact Bonfiglioli.
12	Reserved	-
13	CRC error	The firmware is corrupted, try again the download procedure. If the problem persists, please contact Bonfiglioli.
14	Hardware is not compatible with firmware	The hardware is not compatible with firmware. Try a new download procedure with a compatible firmware or substitute the device with one that has a compatible hardware. In the "Download Firmware" window, choose the desired firmware and press
15	Boot is not compatible with firmware	The Boot is not compatible with the firmware. Try a new download procedure with a compatible firmware or update the boot. The "Download Firmware" window automatically shows the firmwares and the boots that are compatible.
16	Firmware is not compatible with hardware	The firmware is not compatible with the hardware. Try a new download procedure with a compatible firmware or substitute the device with one that has a compatible hardware. In the "Download Firmware" window, choose the desired firmware and press
17	Firmware is not compatible with boot	The firmware is not compatible with the boot. Try a new download procedure with a compatible firmware or update the boot. The "Download Firmware" window automatically shows the firmwares and the boots that are compatible.

ManufacturerDeviceName

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
80	-	-	-	STR	-	CST	-	-

String in ASCII characters showing the name of the device.

ManufacturerHwVersion

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
110	-	-	-	STR	-	CST	-	-

String in ASCII characters showing the hardware version of the device.

ManufacturerSwVersion

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
114	-	-	-	STR	-	CST	-	-

String in ASCII characters showing the software version of the drive.

Identity

Device Identity.

Number of entries

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
-	-	4	4	U8	-	CST	-	-

Number of parameter in this group.

ProductCode

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
122	-	-	-	U32	-	RO	-	-

Identification code of the device.

RevisionNumber

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
124	-	-	-	U32	-	RO	-	-

Device revision.

SerialNumber

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
126	-	-	-	U32	-	RO	-	-

Device serial number.

CpuInfo

Information on the CPU.

Number of entries

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
-	-	2	2	U8	-	CST	-	-

Number of parameter in this group.

CPUSiliconRevision

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
580	-	-	-	U16	-	RO	-	-

CPU revision.

ResetCause

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
581	-	1 ÷ 4	2	U32	-	RW	-	-

Code of the cause that has provoked the firmware reset.

ResetCause	Description
1	Generic reset (cause not found)
2	Reset from power-up (device turn-on)
3	Reset from line of hardware reset
4	Reset from watchdog

12.4. Auxiliary communication port (1100-1199)

AuxiliaryPortSetup

Parameters used to configure the auxiliary communication port.

Number of entries

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
-	-	4	4	U8	-	CST	-	-

Number of parameters in this group.

AuxiliaryPortSetupWordOrder

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
1100	-	0 - 1	0	U16	-	RW	-	EM

Order of the words used by the device, through the auxiliary port, to receive or send the parameters of 32 bits (the byte order of the words is big-endian, as defined by the specification of the Modbus protocol, implemented in the auxiliary port).

Auxiliary Port Setup Word Order	Description	Example
0	Word sent in little-endian format.	The value 0x12345678 is sent in the order 0x5678 0x1234.
1	Word sent in big-endian format.	The value 0x12345678 is sent in the order 0x1234 0x5678.

AuxiliaryPortSetupTimeout

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
1101	-	20 - 65000	50	U16	ms	RW	-	EM

Timeout of the auxiliary port. If the time between two consecutive characters overcomes this value, the interface cancels the ongoing receiving of the whole frame and it prepares to receive a new frame.

AuxiliaryPortSetupBaudRateImmediate

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
1110	-	19200 , 57600	57600	U32	bit/s	RW	-	-

Parameters used for the immediate exchange of the baud rate of the auxiliary port. Once received the request to change the baud rate, the device sends the answer with the precedent baud rate and only after it configures the communication interface with the new baud rate.

AuxiliaryPortSetupBaudRate

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
1112	-	19200 or 57600	57600	U32	bit/s	RW	-	EM

Auxiliary port baud rate. This parameter, once written and saved in the permanent memory, take effect only after the device switching off and on again.

AuxiliaryPortError

Parameters to read the last error condition in writing or reading carried out with the auxiliary communication port.

Number of entries

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
-	-	2	2	U8	-	CST	-	-

Number of parameters in this group.

AuxiliaryPortErrorParam

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
1120	-	-	0	U16	-	RW	-	-

Modbus address of the parameter that generated the last error condition during the writing/reading phase with the auxiliary communication port. An access in writing provokes the resetting of this parameter and of the [AuxiliaryPortErrorCode](#) parameter.

AuxiliaryPortErrorCode

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
1121	-	Desc	0	U16	-	RW	-	-

Code of the last error condition found during the writing/reading phase with the auxiliary communication port. An access in writing provokes the resetting of this parameter and of the [AuxiliaryPortErrorParam](#) parameter. The meaning of the codes can be found in [Table 10.3](#).

12.5. Monitor and diagnostic of the power supply (2000-2099)

HVDC_OutputVoltage

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2001	-	-	0	U16	0.1 V	RO	-	-

RMS value of the HVDC output voltage.

PowerSupplyType

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2002	-	0 ÷ 2	0	U16	-	RO	-	-

Power supply type (alternate voltage) on input section (0=not supplied, 1=single-phase, 2=three-phase).

Value	Description
0	Not powered
1	Single-phase
2	Three-phase

CPU_Temperature

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2010	-	-250 ÷ 1200	-	S16	0.1°C	RO	-	-

Instantaneous CPU temperature.

ControlSectionTemperature

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2011	-	-250 ÷ 1200	-	S16	0.1°C	RO	-	-

Control section instantaneous temperature.

PowerSectionTemperature

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2012	-	-250 ÷ 1200	-	S16	0.1°C	RO	-	-

Power section instantaneous temperature.

ActualCurrent

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2013	-	-	0	S16	0.1 A	RO	-	-

Power supply output instantaneous current. In the version with two output channels this parameter represents the sum of the currents of the two channels (see [ActualCurrentCH1](#) and [ActualCurrentCH2](#)).

ActualCurrentLimit

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2014	-	-	-	U16	0.1 A	RO	-	-

Power supply output current limit, conditioned by [HVDC_OutputVoltage](#).

AverageCurrent

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2015	-	-	-	S16	0.1 A	RO	-	-

Power supply average current. In the version with two output channels this parameter represents the sum of the average currents of the two channels (see [AverageCurrentCH1](#) and [AverageCurrentCH2](#)).

ActualPower

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2016	-	-	-	S32	0,01 W	RO	-	-

Power supply output actual power. In the version with two output channels this parameter represents the sum of the powers of the two channels (see [ActualPowerCH1](#) and [ActualPowerCH2](#)).

Energy values

Values of the energy that's absorbed and provided by the power supply.

Number of entries

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
-	-	8	8	U8	-	CST	-	-

Number of parameters in this group.

ActualDeviceEnergyOverload

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2020	-	-	-	U32	A ² s	RO	-	-

Actual value of overload energy provided by the power supply (I^2T).

BrakeEnergy

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2026	-	-	0	U32	0,001 J	RO	-	EM

Energy absorbed by the braking circuit. This circuit intervenes in case of overvoltage, caused for example by the energy that's regenerated by the motors.

ChargeCircuitEnergy

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2028	-	-	-	U32	0,01 J	RO	-	EM

Energy absorbed by the capacitors charging circuit at the power supply start-up (see [Section 6.5, Charge circuit and start-up phase](#)).

DeviceEnergyOverloadPercentage

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2030	-	0 ÷ 32767	0	U16	%	RO	-	-

Percentage value of the overload energy provided to the power supply (related to [ActualDeviceEnergyOverload](#)).

BrakeEnergyOverloadPercentage

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2031	-	0 ÷ 32767	0	U16	%	RO	-	-

Percentage value of the braking circuit overload (see [BrakeEnergy](#)).

ChargeCircuitEnergyOverloadPercentage

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2032	-	0 ÷ 32767	0	U16	%	RO	-	-

Percentage value of the overload energy absorbed by the capacitors charging circuit (see [Section 6.5, Charge circuit and start-up phase](#)).

CableEnergyOverloadPercentage

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2034	-	0 ÷ 32767	0	U16	%	RO	-	EM

Percentage value of the overload energy absorbed by the cables that are connected to the outputs, referred to the [CableCurrentLimit\(CH1\)](#) and [CableCurrentLimit\(CH2\)](#) current limits.

BackfeedEnergy

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2058	-	-	0	S32	J	RO	-	-

Energy poured from the loads that are connected on the outputs (drives, motors, etc.) to the power supply.

DeviceStatus

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2024	-	-	-	U16	-	RO	-	-

Power supply actual logic status (see [Chapter 8, Power supply logical states](#)).

Value	Message on MotionDrive
0	STARTUP
1	CAP. DISCHARGE
2	OFFSET CAL.
3	VAC IN WAIT
4	VOUT CHECK
5	VOUT RIPPLE CHECK
6	OPERATIONAL
7	VOUT HOLD UP
8	WARNING
9	FAULT
10	POWER DOWN

LastFaultCause

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2025	-	-	0	U16	-	RO	-	-

Last detected fault code (see [Table 10.1](#)).

BrakeDutyCycle

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2033	-	-	0	U16	%	RO	-	-

Duty cycle of the braking circuit, expressed in %.

Current RMS values

RMS current values.

Number of entries

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
-	-	4	4	U8	-	CST	-	-

Number of parameters in this group.

RMS = root-mean-square value of the current signals

NOTE

The calculation period of the RMS value can be set through the [RMS_Average_CalculationPeriod](#) parameter.

RMS_Current

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2048	-	-	0	S32	0.1 A	RO	-	-

Total root-mean-square value calculated with the contribution of [RMS_OutputCurrent](#) and [RMS_BackfeedingCurrent](#).

RMS_OutputCurrent

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2052	-	-	0	S32	0.1 A	RO	-	-

Root-mean-square current provided by the power supply.

RMS_BackfeedingCurrent

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2054	-	-	0	S32	0.1 A	RO	-	-

Root-mean-square current absorbed by the power supply.

AveragePower

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2056	-	-	0	S32	0.01 W	RO	-	-

Average power provided by the power supply.

Temperature Limits

Temperature Limit.

Number of entries

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
-	-	4	4	U8	-	CST	-	-

Number of parameters in this group.

ControlSideFaultTemperature

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2060	-	-	85,0°	S16	0.1°C	RO	-	ES

Temperature fault threshold of the control section.

ControlSideWarningTemperature

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2061	-	-	700	S16	0.1°C	RO	-	ES

Temperature warning threshold of the control section.

PowerSideFaultTemperature

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2064	-	-	900	S16	0.1°C	RO	-	ES

Temperature fault threshold of the power section.

PowerSideWarningTemperature

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2065	-	-	800	S16	0.1°C	RO	-	ES

Temperature warning threshold of the power section.

FaultLockTime

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2068	-	-	Desc	S32	ms	RO	-	-

Power supply lock time in case of fault (permanent fault status and output voltage not present) before the system can be restored and returns operative. To every fault a restore time is related, for details see [Table 10.1](#)

12.6. Power supply configuration (2100-2199)

DeviceModel

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2100	-	1 ÷ 2	Desc	U16	-	RO	-	ES

*i*BMD-DC model: 1 = *i*BMD-DC20; 2 = *i*BMD-DC40.

AutomaticRestartFunction

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2101	-	0 ÷ 1	0	U16	-	RO	-	ES

Automatic restart function: 0 = disabled; 1 = enabled

Voltage values

Voltage values

Number of entries

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
-	-	2	2	U8	-	CST	-	-

Number of parameters in this group.

MinVoutFaultThreshold

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2102	-	-	1000	U16	0.1 V	RO	-	ES

Minimum output voltage value, under which the power supply enters in fault status.

MaxVoutFaultThreshold

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2103	-	-	8300	U16	0.1 V	RO	-	ES

Maximum output voltage value, over which the power supply enters in fault status.

Brake Circuit Parameters

Values related to the internal braking circuit resistor

Number of entries

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
-	-	3	3	U8	-	CST	-	-

Number of parameters in this group.

IntBrakeResistorValue

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2107	-	-	33	U16	Ω	RO	-	ES

Internal brake resistor value.

IntBrakeResistorNominalEnergy

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2108	-	-	6000	U32	J	RO	-	ES

Nominal energy that can be absorbed by the brake resistor.

IntBrakeResistorNominalPower

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2110	-	-	120	U16	W	RO	-	ES

Nominal power that can be absorbed by the brake resistor.

CapacitorDischargeTimeout

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2114	-	-	4000	U16	ms	RO	-	ES

Waiting time, in case of fault, before to start the capacitors discharge and to reset the output voltage.



WARNING

Don't touch the HVDC output connectors (X7 e X8 Power Output until the capacitors are not totally discharged (HVDC_OutputVoltage = 0Vdc).

User Parameters

Parameters that can be set by the user

Number of entries

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
-	-	6	6	U8	-	CST	-	-

Number of parameters in this group.

RMS_Average_CalculationPeriod

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2112	-	-	1000	U16	ms	RW	-	ES

RMS and average current signals values and power signal average value calculation period.

OutputCurrentLimit

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2134	-	Desc	Desc	U16	0.1 A	RW	-	ES

Output current limit (for the version with 2 channels it's the sum of the CH1 + CH2 currents)

iBMD-DC20		iBMD-DC40	
Range	Default	Range	Default
10 ÷ 200	200	10 ÷ 400	400

OvervoltageLimit

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2135	-	1000 ÷ 8300	8300	U16	0.1 V	RW	-	ES

Output voltage limit.

BrakingCircuitActivationVoltage

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2136	-	1000 ÷ 7850	7850	U16	0.1 V	RW	-	ES

Braking circuit activation voltage.

CableCurrentLimit(CH1)

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2142	-	Desc	Desc	U16	0.1 A	RW	-	ES

Output current limit on channel 1 (for the version with 1 channel this limit is in series to [OutputCurrentLimit](#), so prevails the one with the lower value).

iBMD-DC20		iBMD-DC40	
Range	Default	Range	Default
10 ÷ 250	100	10 ÷ 250	200

CableCurrentLimit(CH2)

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2145	-	Desc	Desc	U16	0.1 A	RW	-	ES

Output current limit on channel 2 (for the version with 1 channel this limit is ignored).

iBMD-DC20		iBMD-DC40	
Range	Default	Range	Default
10 ÷ 250	100	10 ÷ 250	200

External Brake Settings

Braking circuit configuration parameters

Number of entries

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
-	-	4	4	U8	-	CST	-	-

Number of parameters in this group.

BrakeCircuitSelector

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2137	-	0 ÷ 2	0	U16	-	RW	-	ES

Configuration of the active braking circuit: 0 = internal; 1 = external; 2 = internal + external.

ExtBrakeResistorNominalEnergy

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2138	-	100 ÷ 2000000	6000	U32	J	RW	-	ES

Nominal energy that can be absorbed by the brake resistor.

ExtBrakeResistorNominalPower

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2140	-	100 ÷ 40000	120	U16	W	RW	-	ES

Nominal power that can be absorbed by the brake resistor.

ExtBrakeResistorValue

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2141	-	16 ÷ 1000	33	U16	Ω	RW	-	ES

External brake resistor value.

12.7. Fault and Warning (2400-2499)

RetentiveWarning

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2400	-	-	0	U32	-	RW	-	-

Retentive Warnings mask. By writing 0 in this parameter, all the active warnings reset.

DynamicWarning

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2402	-	-	0	U32	-	RO	-	-

Dynamic Warnings mask.

RetentiveFault

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2404	-	-	0	U32	-	RW	-	-

Retentive Fault mask. By writing 0 in this parameter, all the active faults reset.

DynamicFault

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2406	-	-	0	U32	-	RO	-	-

Dynamic Fault mask.

12.8. Output channels monitor (2500-2699)

Channel 1 current values

Channel 1 current value.

Number of entries

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
-	-	5	5	U8	-	CST	-	-

Number of parameters in this group.

Legend for the RMS parameter reading:

- P = Current provided by the power supply
- N = Current absorbed by the power supply
- RMS = root-mean-square value of the current signals

NOTE

The calculation period of the RMS value can be set through the [RMS_Average_CalculationPeriod](#) parameter.

RMS_CurrentCH1

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2548	-	-	0	S32	0.1 A	RO	-	-

Total root-mean-square value calculated with the contribution of [RMS_OutputCurrentCH1](#) and [RMS_BackfeedingCurrentCH1](#).

RMS_OutputCurrentCH1

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2552	-	-	0	S32	0.1 A	RO	-	-

Root-mean-square current provided by the power supply on the channel 1.

RMS_BackfeedingCurrentCH1

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2554	-	-	0	S32	0.1 A	RO	-	-

Root-mean-square current absorbed by the power supply on channel 1.

ActualCurrentCH1

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2513	-	-	0	S16	0.1 A	RO	-	-

Power supply output instantaneous current for channel 1 (in the version with 1 channel this value coincides with the [ActualCurrent](#) parameter).

AverageCurrentCH1

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2515	-	-	0	S16	0.1 A	RO	-	-

Power supply output average current for the channel 1 (in the version with 1 channel this value coincides with the [AverageCurrent](#) parameter).

Channel 1 power values

Power values of channel 1.

Number of entries

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
-	-	2	2	U8	-	CST	-	-

Number of parameters in this group.

ActualPowerCH1

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2516	-	-	0	S32	0,01 W	RO	-	-

Power supply output actual power value for the channel 1 (in the version with 1 channel this value coincides with the [ActualPower](#) parameter).

AveragePowerCH1

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2556	-	-	0	S32	0.01 W	RO	-	-

Average power provided by the power supply to the channel 1.

Channel 1 energy values

Values of the energy that's absorbed and provided by the power supply from the channel 1.

Number of entries

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
-	-	3	3	U8	-	CST	-	-

Number of parameters in this group.

ActualDeviceEnergyOverloadCH1

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2520	-	-	-	U32	A ² s	RO	-	-

Actual value of overload energy provided by the power supply (I^2T) on the channel 1.

DeviceEnergyOverloadPercentageCH1

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2530	-	-	0	U16	%	RO	-	-

Percentage value of the overload energy provided to the power supply on the channel 1 (related to [ActualDeviceEnergyOverloadCH1](#)).

CableEnergyOverloadPercentageCH1

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2534	-	-	0	U16	%	RO	-	EM

Percentage value of the overload energy absorbed by the cables that are connected to the channel 1.

Channel 2 current values

Channel 2 current value.

Number of entries

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
-	-	5	5	U8	-	CST	-	-

Number of parameters in this group.

Legend for the RMS parameter reading:

- P = Current provided by the power supply
- N = Current absorbed by the power supply
- RMS = root-mean-square value of the current signals

NOTE

The calculation period of the RMS value can be set through the [RMS_Average_CalculationPeriod](#) parameter.

RMS_CurrentCH2

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2648	-	-	0	S32	0.1 A	RO	-	-

Total root-mean-square value calculated with the contribution of [RMS_OutputCurrentCH2](#) and [RMS_BackfeedingCurrentCH2](#).

RMS_OutputCurrentCH2

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2652	-	-	0	S32	0.1 A	RO	-	-

Root-mean-square current provided by the power supply on the channel 2.

RMS_BackfeedingCurrentCH2

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2654	-	-	0	S32	0.1 A	RO	-	-

Root-mean-square current absorbed by the power supply on channel 2.

ActualCurrentCH2

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2613	-	-	0	S16	0.1 A	RO	-	-

Power supply output instantaneous current for channel 2 (in the version with 1 channel this value is ignored).

AverageCurrentCH2

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2615	-	-	0	S16	0.1 A	RO	-	-

Power supply output average current for the channel 2 (in the version with 1 channel this value is ignored).

Channel 2 power values

Power values of channel 2.

Number of entries

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
-	-	2	2	U8	-	CST	-	-

Number of parameters in this group.

ActualPowerCH2

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2616	-	-	0	S32	0,01 W	RO	-	-

Power supply output actual power value for the channel 2 (in the version with 1 channel this value is ignored).

AveragePowerCH2

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2656	-	-	0	S32	0.01 W	RO	-	-

Average power provided by the power supply to the channel 2.

Channel 2 energy values

Values of the energy that's absorbed and provided by the power supply from the channel 2.

Number of entries

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
-	-	3	3	U8	-	CST	-	-

Number of parameters in this group.

ActualDeviceEnergyOverloadCH2

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2620	-	-	-	U32	A ² s	RO	-	-

Actual value of overload energy provided by the power supply (I^2T) on the channel 2.

DeviceEnergyOverloadPercentageCH2

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2630	-	-	0	U16	%	RO	-	-

Percentage value of the overload energy provided to the power supply on the channel 2 (related to [ActualDeviceEnergyOverloadCH2](#)).

CableEnergyOverloadPercentageCH2

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2634	-	-	0	U16	%	RO	-	EM

Percentage value of the overload energy absorbed by the cables that are connected to the channel 2.

12.9. Internal diagnostic (2800-2999)

RectifierBridgeVoltageSignal

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2824	-	-	-	S16	0.1Vdc	RO	-	-

Measured voltage signal of the diode-rectifier bridge.

NOTE

the following parameters report the minimum and maximum values that have been reached by the physical quantities which they refer to. The measurements start at the conclusion of the start-up (power supply on the OPERATIONAL status).

Voltage Min/Max Values

Minimum and maximum HVDC voltage values.

Number of entries

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
-	-	2	2	U8	-	CST	-	-

Number of parameters in this group.

MinHVDC_OutputVoltage

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2900	-	-	0	U16	0.1V	RO	-	-

Minimum value reached by [HVDC_OutputVoltage](#).

MaxHVDC_OutputVoltage

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2901	-	-	0	U16	0.1V	RO	-	-

Maximum value reached by [HVDC_OutputVoltage](#).

Current Min/Max Values

Minimum and maximum current values.

Number of entries

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
-	-	8	8	U8	-	CST	-	-

Number of parameters in this group.

MinRMS_Current

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2905	-	-	0	S16	0.1A	RO	-	-

Minimum value reached by [RMS_Current](#).

MaxRMS_Current

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2906	-	-	0	S16	0.1A	RO	-	-

Maximum value reached by [RMS_Current](#).

MinActualCurrent

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2911	-	-	0	S16	0.1A	RO	-	-

Minimum value reached by [ActualCurrent](#).

MaxActualCurrent

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2912	-	-	0	S16	0.1A	RO	-	-

Maximum value reached by [ActualCurrent](#).

MinActualCurrentCH1

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2926	-	-	0	S16	0.1A	RO	-	-

Minimum value reached by [ActualCurrentCH1](#).

MaxActualCurrentCH1

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2927	-	-	0	S16	0.1A	RO	-	-

Maximum value reached by [ActualCurrentCH1](#).

MinActualCurrentCH2

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2928	-	-	0	S16	0.1A	RO	-	-

Minimum value reached by [ActualCurrentCH2](#).

MaxActualCurrentCH2

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2929	-	-	0	S16	0.1A	RO	-	-

Maximum value reached by [ActualCurrentCH2](#).

Power Max Values

Power maximum values.

Number of entries

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
-	-	1	1	U8	-	CST	-	-

Number of parameters in this group.

MaxAveragePower

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2920	-	-	0	S32	0.01 W	RO	-	-

Maximum value reached by [AveragePower](#).

Energy Max Values

Energy maximum values.

Number of entries

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
-	-	5	5	U8	-	CST	-	-

Number of parameters in this group.

MaxDeviceEnergyOverloadPercentage

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2913	-	-	0	U16	%	RO	-	-

Maximum value reached by [DeviceEnergyOverloadPercentage](#).

MaxActualDeviceEnergyOverload

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2914	-	-	0	U32	0.001 J	RO	-	-

Maximum value reached by [ActualDeviceEnergyOverload](#).

MaxBrakeEnergy

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2916	-	-	0	U32	0.01 J	RO	-	-

Maximum value reached by [BrakeEnergy](#).

MaxChargeCircuitEnergy

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2918	-	-	0	U32	0.01 J	RO	-	-

Maximum value reached by [ChargeCircuitEnergy](#).

MaxBackfeedEnergy

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2922	-	-	0	U32	0.01 J	RO	-	-

Maximum value reached by [BackfeedEnergy](#).

Temperature Min/Max Values

Minimum and maximum temperature values.

Number of entries

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
-	-	4	4	U8	-	CST	-	-

Number of parameters in this group.

MinControlSectionTemperature

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2907	-	-	0	S16	0.1°C	RO	-	-

Minimum value reached by [ControlSectionTemperature](#).

MaxControlSectionTemperature

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2908	-	-	0	S16	0.1°C	RO	-	-

Maximum value reached by [ControlSectionTemperature](#).

MinPowerSectionTemperature

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2909	-	-	0	S16	0.1°C	RO	-	-

Minimum value reached by [PowerSectionTemperature](#).

MaxPowerSectionTemperature

Modbus	CANopen	Range	Default	Type	Units	Acc	PDO	Mem
2910	-	-	0	S16	0.1°C	RO	-	-

Maximum value reached by [PowerSectionTemperature](#).

Chapter 13

Maintenance

 ATTENTION

Check the integrity of the connectors and that the terminals are correctly closed.

 ATTENTION

Before starting the maintenance, read the [Section 2.8, Safety precautions and limits](#). If you do not follow the safety instructions you can cause injury or death.

13.1. Maintenance interval

If the power supply is installed in a correct environment, it requires a minimal maintenance.

The following table shows the maintenance intervals that are recommended by Bonfiglioli.

Maintenance	Interval	Instructions
Heat sink: Temperature control and cleaning	It depends on the dust that's present in the environment (every 6-12 months)	
Capacitor regeneration	Every year when stored	

Table 13.1. Maintenance interval of the iBMD-DC.

Typical lifetime		
Capacitors of the HVDC power section	without line inductance	20000 hours @ 40°C
	with line inductance	30000 hours @ 40°C iBMD-DC20 = inductance 1,2 mH 25Arms iBMD-DC40 = inductance 0,58 mH 50Arms
Cooling fans	Internal (only iBMD-DC40)	MTTF (confidence level 90%) = 90000h
	External (only iBMD-DC40)	MTTF (confidence level 90%) > 200000h

Table 13.2. Components lifetime iBMD-DC.

Chapter 14

Order codes

14.1. OrderCode

The *i*BMD-DC power suppliers differ from one another by the output nominal current value. The order code is the following:

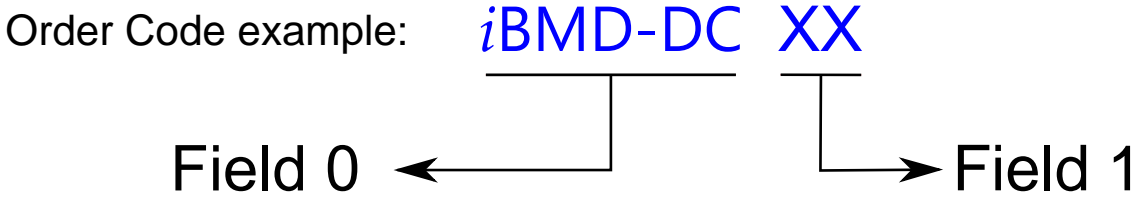


Figure 14.1. Position of the fields in the order code.

Order code		0	1
Field	Description	XXXX-XX	XX
Field 0 (Series)	Three-phase power supply (rectifier)	<i>i</i> BMD-DC	
Field 1 (Current)	Nominal current that can be provided to the 20A output		20
	Nominal current that can be provided to the 40A output		40

Table 14.1. Fields that make up the order code.



Bonfiglioli has been designing and developing innovative and reliable power transmission and control solutions for industry, mobile machinery and renewable energy applications since 1956.