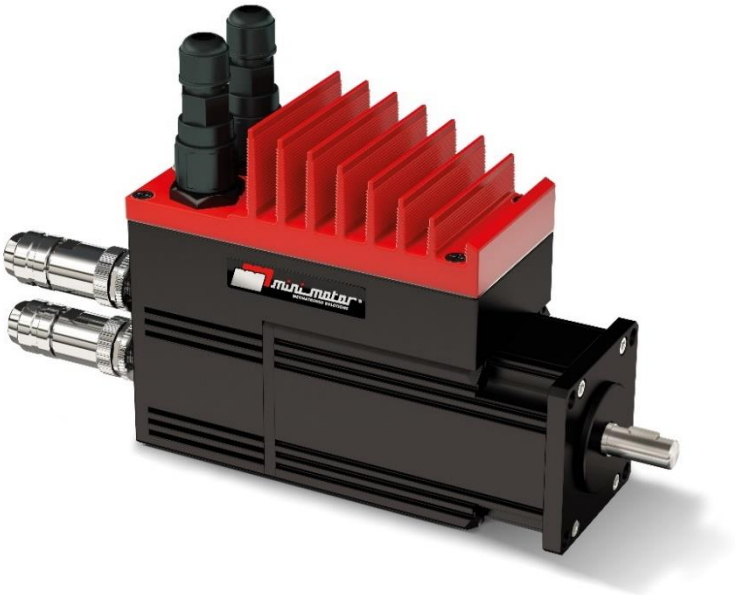
Installation, Use and Maintenance Manual



DBS - Rev 23

*** DBS Firmware ≥ v4.044 ***

Table of contents

1 General information

1.1 Introduction

Thank you for choosing this product. This document is an integral part of the product, as it contains the procedures and parameters necessary for the assembly, installation, wiring, commissioning and support of the product.

The buyer and/or qualified person with knowledge of electrical and/or electronic systems who will use the product need the use and maintenance manual and must keep it available for reference at any moment.

1.2 Safety warnings

Closely follow the precautions given (with warning symbols), as they are crucial for safety:

 General danger symbol

 Dangerous electrical voltage symbol

1.3 Storage and Installation Environment

Do not store or use the product in the following environments:

- ⚠ Exposed to direct sunlight
- ⚠ Exposed to higher levels of temperature, condensation and relative humidity than ones indicated in the specifications table
- ⚠ Exposed to dust, salinity, water, oil, chemicals, corrosive or inflammable gases, fuels
- ⚠ Pollution degree higher than 3
- ⚠ When subject to impact or vibrations

1.4 Transport, installation and wiring

- ⚠ Do not drop the product
- ⚠ Grasp the product by the motor, always checking first to ensure it is not hot – burn danger!
- ⚠ Do not install the product if there are damage signs on the packaging or on the product itself
- ⚠ Wiring must be performed by qualified personnel, with the power supply disconnected
- ⚠ During the installation and wiring operations, protect any product openings with appropriate guards in order to avoid that any kind of conductive metallic object is able to get in
- ⚠ Ensure the connectors are firmly tightened
- ⚠ Install appropriate safety components (fused disconnect switch) up line of the power supply
- ⚠ Use shielded cables in locations subject to static electricity, strong magnetic fields or in the presence of electrical lines
- ⚠ Use suitable and appropriately sized cables for connection of the power supply, motor and control signals connections;

- ⚠ For control signal connections longer than 1m, it is recommended to use shielded cables with the shielding connected to an available earth signal;
- ⚠ Make sure that the power supply voltage complies with the one on the rating plate;
- ⚠ Ensure that there is sufficient ventilation to dissipate the heat produced by the product.
- ⚠ Connect service usb only with the drive powered.

1.5 Operation and adjustments

- ⚠ At first power on or after a period of more than two months of inactivity, it's recommended to keep fed the logical part for at least 24 hours;
- ⚠ Activate the product only after checking the compatibility of the load and of the machine in which it will be installed;
- ⚠ Stay away from the machine when the product is in reboot phase from an error (if the automatic reboot is enabled), because the machine could restart suddenly;
- ⚠ Do not place body parts near the rotating parts;
- ⚠ Use appropriate personal protective equipment during the work near to the axis ends (presence of sharp edges in the tongue seat);
- ⚠ Before performing the machine test, provide adequate protections around the rotating parts (joints, etc.);
- ⚠ Never activate the device or its switches with wet hands

1.6 Maintenance and inspection

- ⚠ The product is equipped with a backup battery used for the multi turn position retain. To guarantee the life performance and expected life it is necessary to perform a complete charge cycle for a minimum time of 24 consecutive hours every 6 months.
- ⚠ Ensure that all safety precautions have been taken before performing maintenance or inspection operations
- ⚠ Do not touch the heatsink and the motor as these components heat up when the product is operational and remain hot even after it is switched off
- ⚠ Do not uninstall the product when it is powered, switch it off then wait at least two minutes before doing so
- ⚠ Do not change the wiring, the supply voltages, etc. while the product is powered
- ⚠ Do not repair or modify the product
- ⚠ The product does not require any particular preventive maintenance. However, we recommend performing the following checks regularly:
    - Check the condition and tightening of the connections
    - Check that the heatsink is clean and ventilated
- Do not treat the product as normal domestic waste: it must be taken to an appropriate collection point for electrical and electronic waste. Failure to observe this requirement can lead to civil and/or criminal penalties, and could have damaging consequences for the environment and human health

1.7 UR Requirement (For motor with UR marking)

For UR compliance this conditions **MUST** be met

- ⚠ Surrounding air temperature range: 0°C ÷ 40°C
- ⚠ Use in Pollution degree 3 Environment

- ⚠ **Must** Use an external protection fuse with the following characteristics

Motor Size	Cathegory	Class	Voltage Rating	Current Rating (A)	Simmetrica A.I.C. (KA)
55/50 – 55/100	JDDZ/JDDZ7	Class CC	300 Vdc	20°	20KA
80/50 – 80/100	JDDZ/JDDZ7	T	160 Vdc	50°	20KA

- ⚠ Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the Manufactirer Instructions, National Electrical Code and any additional local codes

- ⚠ The Drive does not provide Motor Overload protection. External or remote Motor Overload protection shall be provided in the end-use applications
- ⚠ The Drive is intended to be used with motors that must have integral thermal protection: the integral thermal protection signal shall be connected to the equipment, on terminal 3 of U17 and U18. Signal was rated maximum 3.3Vdc.

1.8 Product checks

Upon delivery of the product, we recommend checking that it corresponds to that ordered and is complete. Keep in mind that only the connectors to wire the device (power, signals and bus) are included in the package. Contact the supplier's technical support service for any problems relating to the product. For UR products check accettability conditions and end user advice, which can be found on UL database at the file number 503911.

1.9 Label Checks

1.9.1 CE Label

Example of label applied to the product:

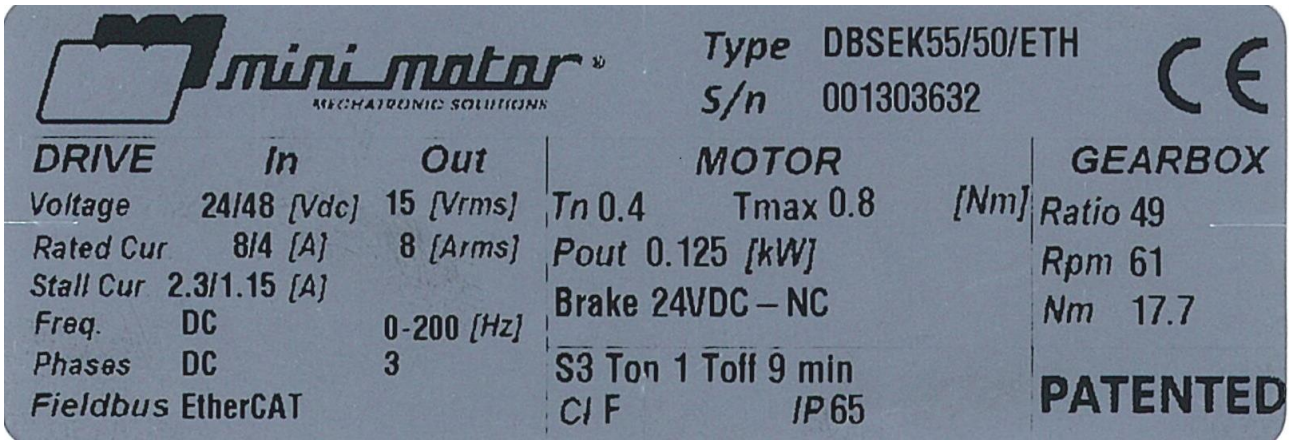


Figure 1

Type	Product Name	
S/n	Serial Number	
DRIVE		
	DRIVE IN	DRIVE OUT
Voltage	Drive Input Voltage [Vdc]	Drive output Voltage [VRMS]
Current	Driver Input Current [A]	Drive Output Current [Arms]
Stall Cur.	Stall Current	
Freq	Drive input frequency	Drive output frequency
Phases	Drive input phases	Drive output phases
Fieldbus	Fieldbus protocol and optionals CSP/TP/DP/STO/MA	
MOTOR		
Tn	Nominal motor torque [Nm]	
Tmax	Peak torque [Nm]	
Pout	Output motor power [kW]	
Cl	Insulation class	
IP	IP protection code	
S3	Duty Service according to IEC 34-1 with on and off times. If absent, assume S1 service	
Brake	Brake Voltage and operation mode, if present	
GEARBOX		
Ratio	Gearbox ratio	
Rpm	Nominal output speed [rpm]	
Nm	Nominal output torque [Nm]	

Table 1

1.9.2 UR label

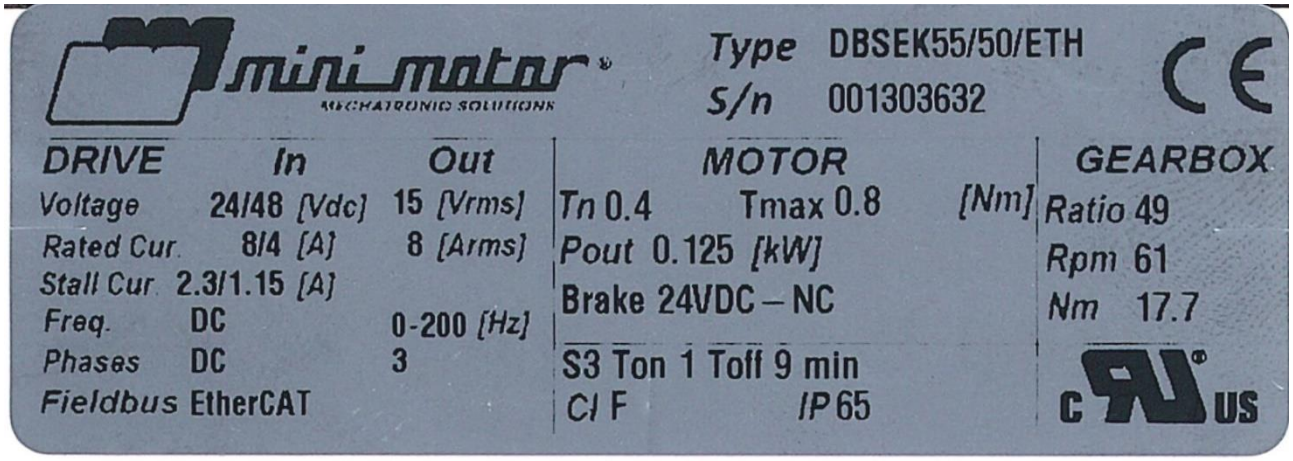


Figure 2

Type	Product Name	
S/n	Serial Number	
DRIVE		
	DRIVE IN	DRIVE OUT
Voltage	Drive Input Voltage [Vdc]	Drive output Voltage [VRMS]
Current	Driver Input Current [A]	Drive Output Current [Arms]
Stall Cur.	Stall Current	
Freq	Drive input frequency	Drive output frequency
Phases	Drive input phases	Drive output phases
Fieldbus	Fieldbus protocol and optionals CSP/TP/DP/STO/MA	
MOTOR		
Tn	Nominal motor torque [Nm]	
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Cl	Insulation class	
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Brake	Brake Voltage and operation mode, if present	
GEARBOX		
Ratio	Gearbox ratio	
Rpm	Nominal output speed [rpm]	
Nm	Nominal output torque [Nm]	

1.10 Product technical specification

Technical Characteristic		
	DBS55/50/xx	DBS55/100/xx
Nominal Supply Voltage	24Vdc – 48Vdc	48Vdc
Nominal Supply Current	8A@24Vdc – 4A@48Vdc	6,6A
Logic power draw	2.4W	
Nominal Speed	3000rpm	
Nominal Torque[1]	0.4Nm	0.75Nm
Motor power output	125W	235W
Motor rated current	8Arms	6,6Arms
Nominal overload	200% per 60 seconds	
PWM Frequency	4/8/12 kHz	
Motor Control Algorithm	Sinusoidal Brushless Magnetic multi turn absolute encoder (12bit single turn 20bit multi turn) 4096 pulse/rev.	
Electromagnetic motor brake control (optional)	24Vdc max. 0.5A	
Operative mode	Velocity, Torque, Position, Homing control	
Fieldbus operative mode (optional)	Velocity, Torque, position, Homing control, CSP (ECAT & Powerlink)	
Digital input	2 pnp (24Vdc max 500kHz) 3 pnp (24Vdc IEC 61131-2 max 7kHz) of wich 2 settable as STO (Optional only on request) “STO on our product are designed for SIL3 following EN61800-5-2 standard”.	
Analogue input	[0 ÷ 10]Vdc [-10 ÷ +10]Vdc [4 ÷ 20]mA - Optional only on request	
Outputs	1 NO 2A 30Vdc	
Service communication	µUSB	
Communication fieldbus (optional)	Ethercat Ethernet IP PowerLink ProfiNET Modbus RTU CanOpen	
(Main) protection features	Polarity inversion, overcurrent, overvoltage, under voltage, overheating, overload, memory error, communications error	
Cooling	Natural	
Standard ingress protection	IP65	
Ambient operating temperature	[0 ÷ 40]°C	
Installation environment	Pollution class 3 Free from direct sunlight, vibrations, dust, corrosive or inflammable gases, oil vapour, fogs, water and humidity with or without a high salinity level	
Humidity	[20 - 90]% RH (not condensing - not corrosive)	
Installation Position	Maximum altitude 1000m asl	
Storage temperature	[-20 ÷60]°C (transient temperatures during transport only)	
Weight	1.65kg	2.35kg
Conformity	CE, complies with EMC directive 2014/30/UE, C3 class, industial enviroment	
Vibration e Shock[2]	Sinusoidal: 0.22 mm (10 ... 60Hz) 30 m/s^2 (60 ... 500 Hz)	Shock Semi-sinusoidal: 250 m/s^2(11ms)

[1] With flanged motor on [300x300x20]mm steel plate.

[2] Sinusoidal: 10 tests as per IEC 60068-2-6 – Shock-Semi-sinusoidal: 3 shock per direction as per IEC 60068-2-27

Technical Characteristic		
	DBS 80/50/---	DBS 80/100/---
Nominal Supply Voltage	48Vdc	48Vdc
Nominal Supply Current	9,1A	15,7A
Logic Power Draw	2.4W	
Nominal Speed	3000rpm	
Nominal Torque[3]	1,1Nm	2Nm
Motor power output	345W	630W
Motor rated current	12,8Arms	23Arms
Nominal overload	150% per 60 secondi	
PWM Frequency	4/8/12 kHz	
Motor Control Algorithm	Sinusoidal Brushless Magnetic multi turn absolute encoder (12bit single turn 20bit multi turn) 4096 pulse/rev.	
Electromagnetic motor brake control (optional)	24Vdc max. 0.5A	
Operative mode	Velocity, Torque, Position, Homing control	
Fieldbus operative mode (optional)	Velocity, Torque, Position, Homing control	
Digital input	2 pnp (24Vdc max 500kHz) 3 pnp (24Vdc IEC 61131-2 max 7kHz) of wich 2 settable as STO (Optional only on request) “STO on our product are designed for SIL3 following EN61800-5-2 standard”.	
Analogue input	[0 ÷ 10]Vdc [-10 ÷ +10]Vdc [4 ÷ 20]mA - Optional only on request (MA)	
Outputs	1 NO 2A 30Vdc	
Service communication	USB	
Communication fieldbus (optional)	Ethercat Ethernet IP PowerLink ProfiNET Modbus RTU CanOpen	
(Main) protection features	Polarity inversion, overcurrent, overvoltage, under voltage, overheating, overload, memory error, communications error	
Cooling	Naturale	
Standard ingress protection	IP65	
Ambient operating temperature	[0÷40]°C	
Installation environment	Pollution class 3 Free from direct sunlight, vibrations, dust, corrosive or inflammable gases, oil vapour, fogs, water and humidity with or without a high salinity level	
Humidity	[20 - 90]% RH (not condensing - not corrosive)	
Installation Position	Maximum altitude 1000m asl	
Storage temperature	[-20 ÷60]°C (transient temperatures during transport only)	
Weight	3.2kg	4.7kg
Conformity	CE, complies with EMC directive 2014/30/UE, C3 class, industial enviroment	

[3] With flanged motor on [300x300x20]mm steel plate.

1.11 Optionals

Optional features avalaible on the DBS family. If the motor has one or more of this features, their code will appear in the label.

Code	*Functionality*	*Description*
MA	MilliAmpere	Analogic input in current instead of voltage
STO	Safety Torque Off	Dual 24V line for safety deactivation of the motor
DO	Digital Output	Logic power routed to digital output, maximum 40mA
CSP	Cyclic Synchronous Position	Master controlled motor trajectory for EtherCAT and Powerlink
TP	Touch Probe	Istantaneous capture of actual potition
K	Holding Brake	24V NC holding brake

1.12 Torque Speed Characteristic

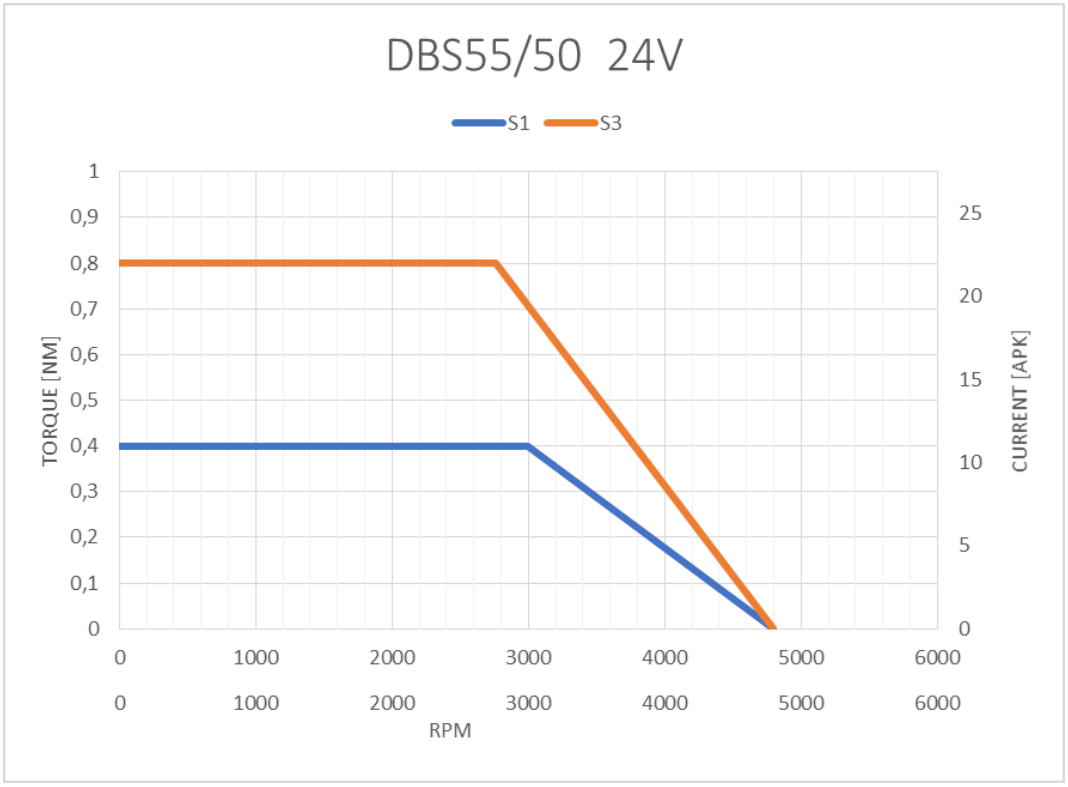


Table 2

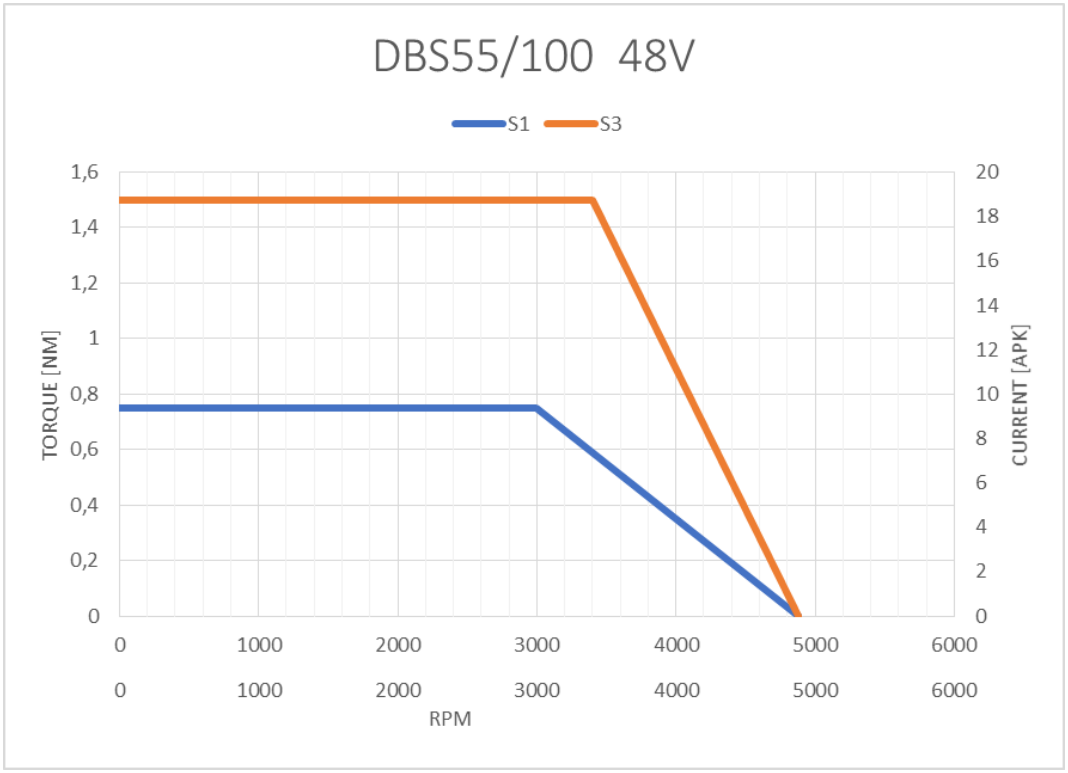


Table 3

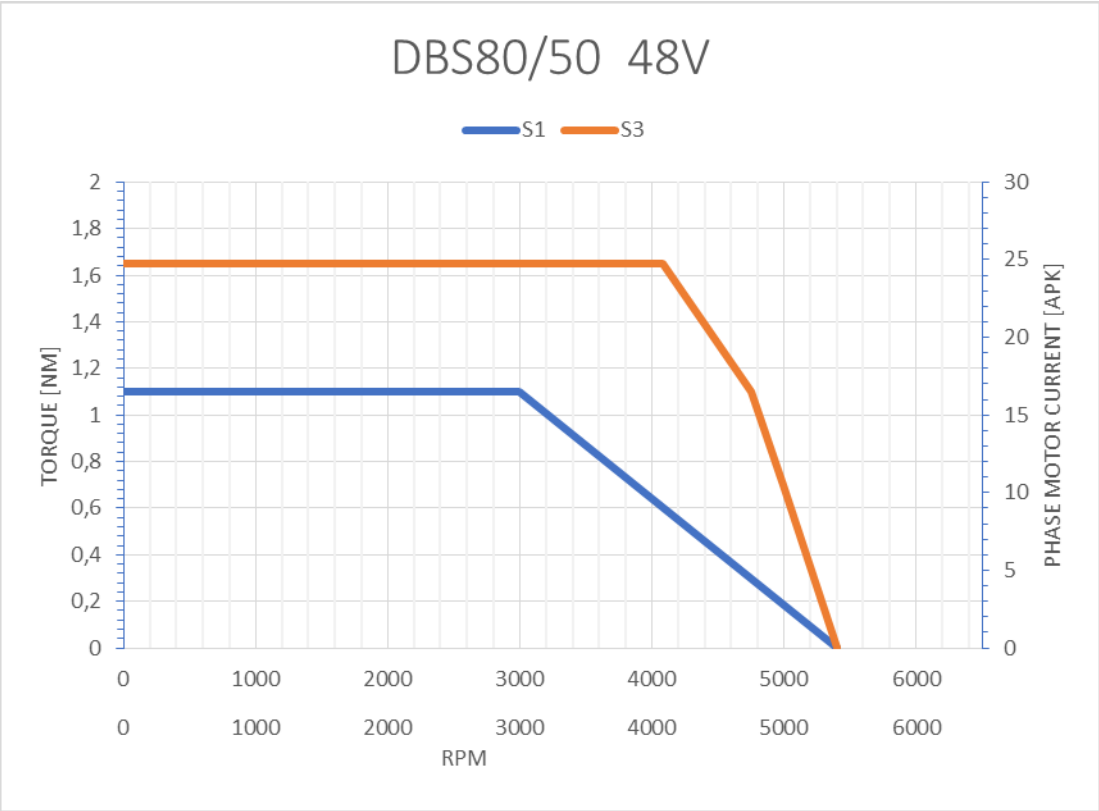


Table 4

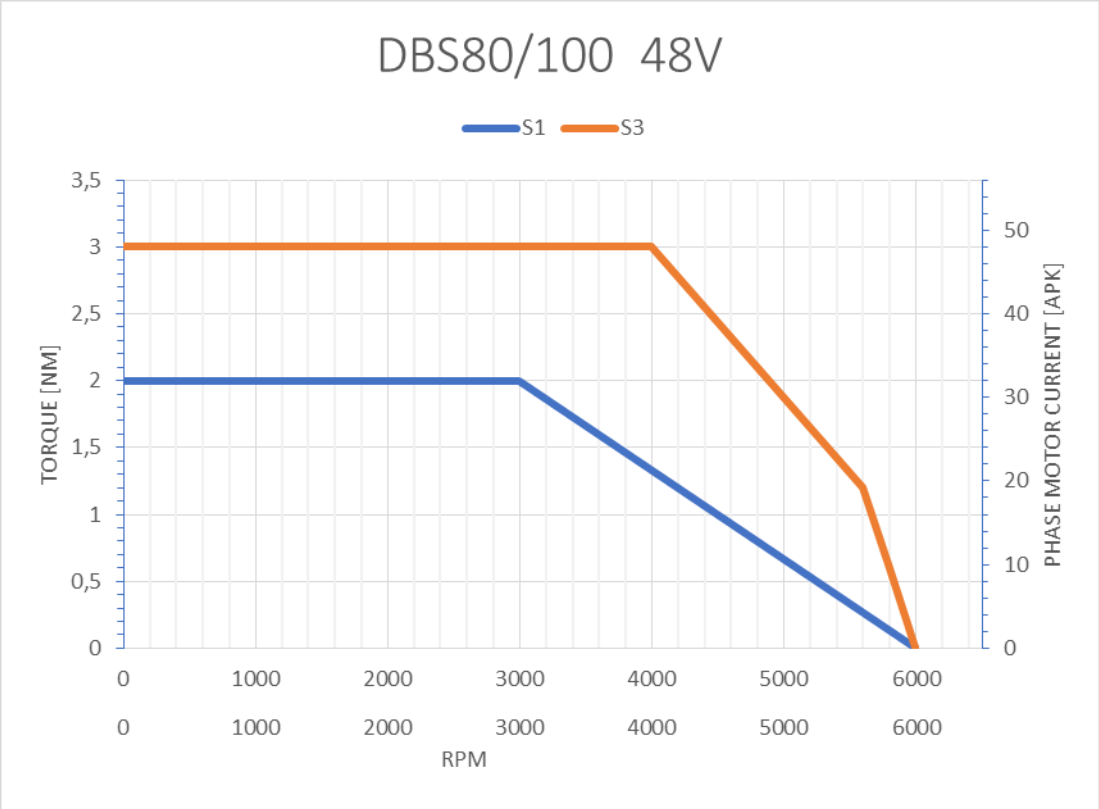


Table 5

1.13 S3 Service

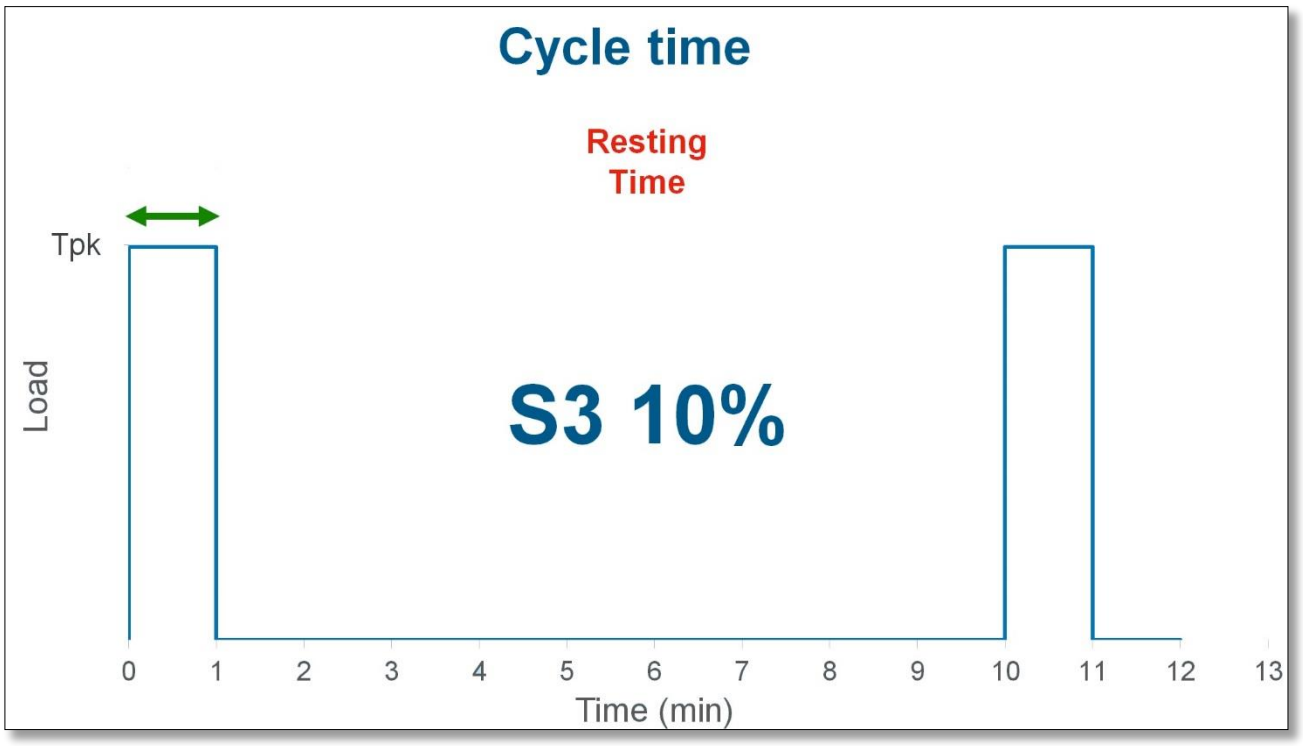


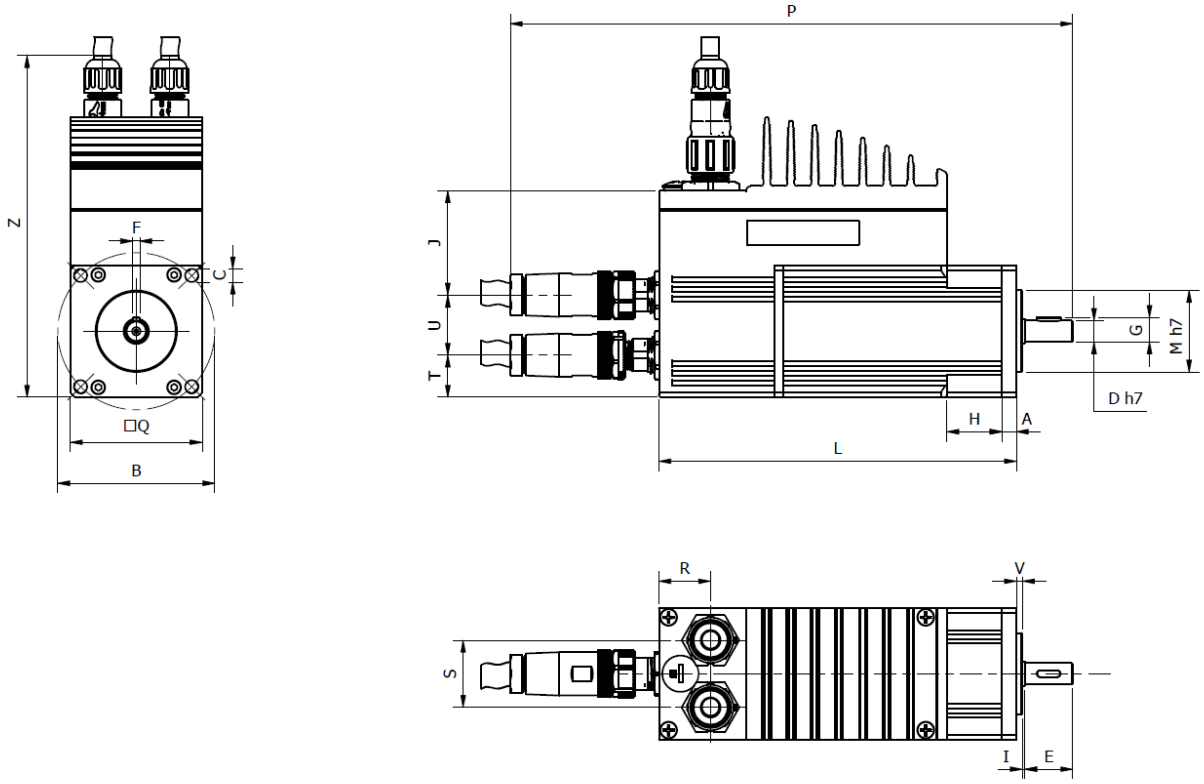
Figure 2

The DBS Motor in S3 configuration has an intermittent Duty Cycle S3 10%, meaning:

- **On Time** 1 Minute using up to 200% nominal Torque
- **Off Time** 9 minutes

2 Installation

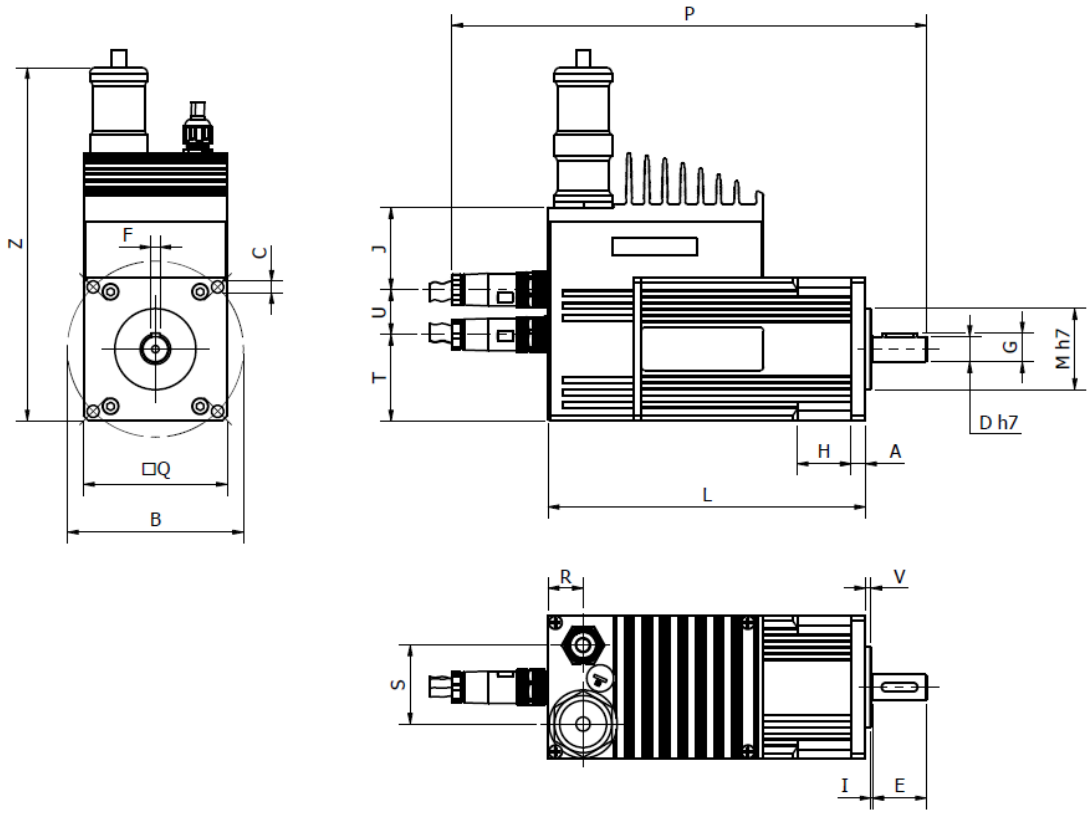
2.1 Dimensions DBS55



Tipo Type Typ Type Tipo	A	B	C	D	E	F	G	H	J	I	L	M	P	Q	R	S	T	U	V	Z	Peso Weight Gewicht Poids Peso kg
DBS 55/50	6	65,5	5,5	9	20	3	10,2	23	43,5	1	149	34	235	55	21,5	28	17,5	25	2,5	139	1,58
DBS 55/100	6	65,5	5,5	9	20	3	10,2	23	43,5	1	199	34	285	55	21,5	28	17,5	25	2,5	139	2,33

Table 6

2.2 Dimensions DBS 80



Tipo Type Typ Type Tipo	A	B	C	D	E	F	G	H	J	I	L	M	P	Q	R	S	T	U	V	Z	Peso Weight Gewicht Poids Peso kg
DBS 80/50	8	98	6,5	14	30	5	16	30	47	1	177	45	235	80	19,5	44	48	25	3	200	3,2
DBS 80/100	8	98	6,5	14	30	5	16	30	47	1	227	45	285	80	19,5	44	48	25	3	200	4,7

Table 7

DBSE and MCDBS variants and general product drawings and 3D models can be downloaded from the Cadenas'PART Community at the following links:

- **DBS /---/---**
  https://www.minimotor.com/prodotti/dbs/#configuratore

- **MCDBS 55/50/---**
  https://www.minimotor.com/prodotti/mcdbs/#configuratore

- **DBSE /---/---**
  https://www.minimotor.com/prodotti/dbse-servomotoriduttori-brushless-con-azionamento-integrato/#configuratore

2.3 Electric connections

Please note that the device power supply does not have a direct connection with the system earth.

WARNING: The Power must be supplied by a stabilized PSU. Protection fuse advised.

2.4 Power supply connector CN1 – DBS 55

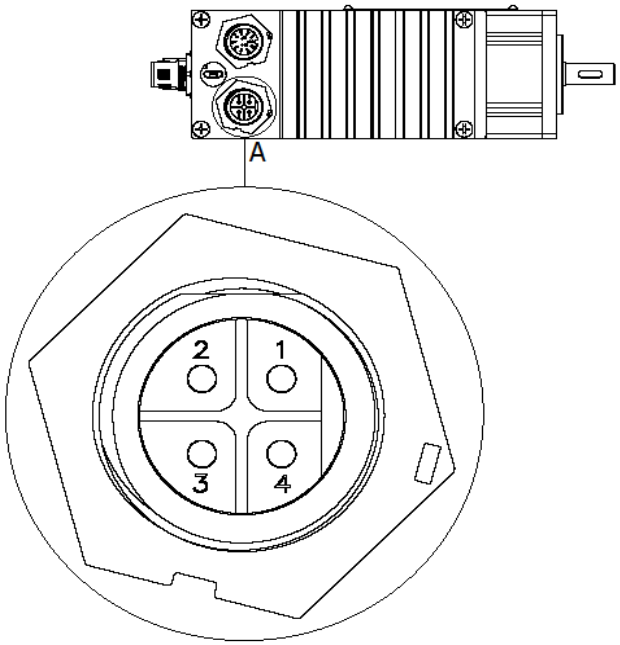


Figure 3

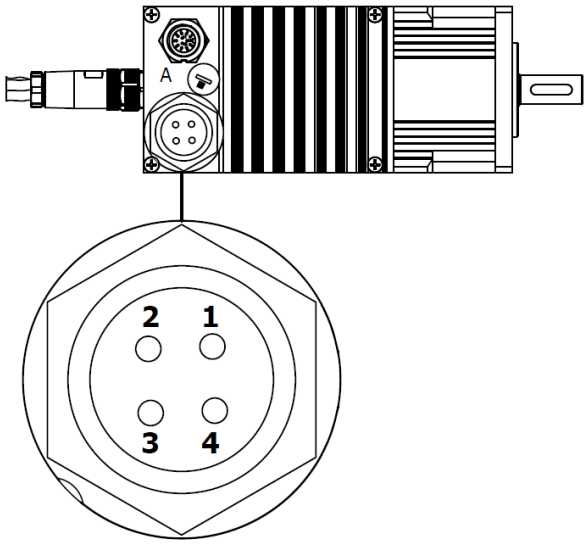
CN1				
Pin		**Descrizione**	**55/50/----**	**55/100/----**
1		Logic GND	0V	0V
2		Power GND	0V	0V
3		+ Power	From 24 to 48Vdc	48Vdc
4		+ Logic	From 24 to 48 Vdc	

Awg 18 cable is recommended for power connection.

WARNING: the picture represents the top view of the connector fixed on the motor case.

WARNING: Logic and Power GND must have common ground.

2.5 Connettore di alimentazione CN1 – DBS 80



CN1				
Pin		**Descrizione**	**80/50/----**	**80/100/----**
1		GND logic	0V	0V
2		+Power	48Vdc	48Vdc
3		GND Power	0V	0V
4		+ Logic	From 24 to 48Vdc	

Awg 11 cable is recommended for power connection.

WARNING: the picture represents the top view of the connector fixed on the motor case.

WARNING: Logic and Power GND must have common ground.

Figure 4

2.6 I/O connector CN2

Use a shield cable Awg 22 for control connection

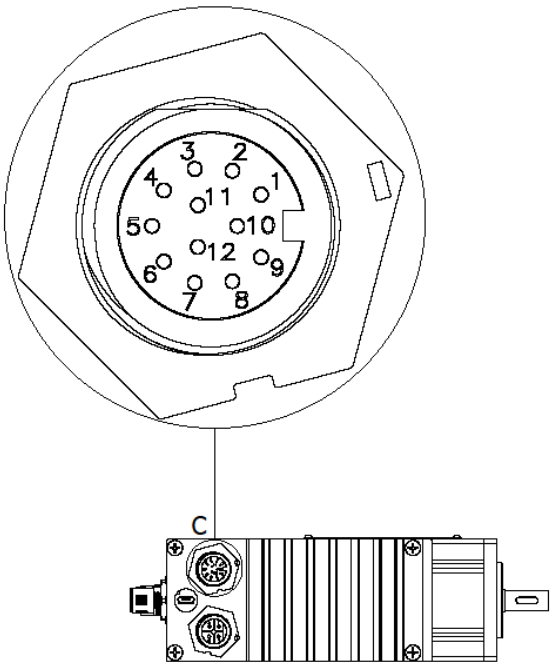


Figure 4

CN2				
Pin		**ID**	**Description**	
1		DIN 1	Multifunction digital input 24Vdc pnp max 500kHz	
2		DIN 2		
3		DIN 3 / S1+	Multifunction digital input24Vdc pnp max 7kHz	*STO In 1
4		DIN 4 / S2+		*STO In 2
5		DIN 5		
6		DIN GND	Digital input ground	** Logic GND (Pin1 CN1)
7		AIN +	Positive input for analog signal***	
8		AIN -	Negative input for analog signal***	
9		AGND	Ground for analog signal	
10		+10Vdc	Service power for analog input max 5mA	
11		Com	Relay common digital output	
12		NO	NO contact relay digital output max 2A	** + Logic (Pin 4 CN1)

*** STO Optional on request.**

****DO logic supply on CN2 connector optional on request, maximum 40mA of output.**

*****MA Analog input configured for 0-20mA / 4-20mA optional on request.**

2.7 USB service connector CN4

Unscrew the metal cap to access the connector shown in Figure 5.

By using this micro USB connection, it is possible to set the device trough the specific BSI software. You can download it here: https://www.minimotor.com/en/products/dbs/

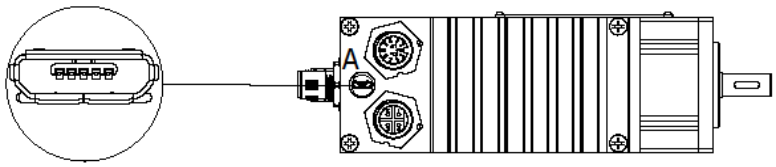


Figure 5

⚠ The USB cable must be connected to the DBS system only with the drive powered up

2.8 Fieldbus connection

The optional available fieldbuses are:

- CanOpen/Modbus RTU defined by “C” in the final part of the product name;
- Ethercat defined by “ETH” in the final part of the product name;
- Ethernet IP defined by “EIP” in the final part of the product name;
- Powerlink defined by “EPL” in the final part of the product name;
- Profinet defined by “EPN” in the final part of the product name.

Maximum tightening torques for connections: 0.5 Nm.

For the CanOpen/Modbus model the connectors on the DBS are M12 5 poles A coded, one male and one female.

For the EtherCAT/Profinet/Powerlink/EthernetIP models the connectors on the DBS are M12 4 poles D coded female.

2.8.1 CanOpen/Modbus RTU (55/---/C)

The wirings and LEDs in **Errore. L'origine riferimento non è stata trovata.** Refer to the CanOpen/Modbus RTU equipped version.

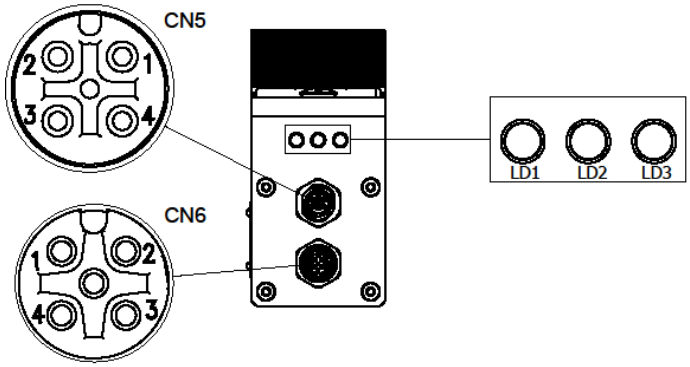


Figure 6

The pin function is the same for CN5 and CN6.

WARNING: if more devices are connected together, pin 3 (GND) need to be connected ***ONLY*** if the logic power supply is not common (different GND).

Pin	CanOpen	Modbus RTU
1	Housing Shield	
2	Not connected	
3	CAN GND	GND
4	CAN H	485 B
5	CAN L	485 A

Details about Led status are explained on chapter 5.1

2.8.2 CanOPEN over EtherCAT (55/---/ETH)

The wirings and LEDs in Figure 11 refer to the CanOpen over EtherCAT equipped version.

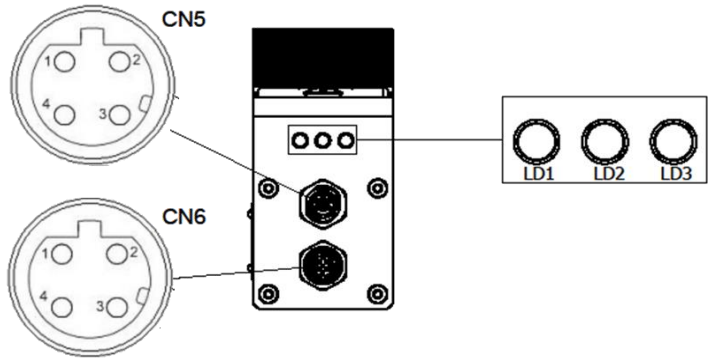


Figure 7

The pin function is the same for CN5 and CN6.

CN5 connector --- input

CN6 connector --- output

Pin	CanOpen over EtherCAT
1	TX+
2	RX+
3	TX-
4	RX-

Details about Led status are explained on chapter 5.2

2.8.3 Ethernet IP (55/---/EIP)

The wirings and LEDs in Figure 12 refer to the Ethernet IP equipped version.

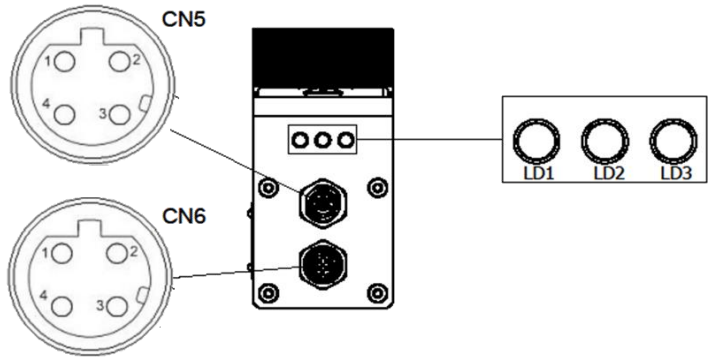


Figure 8

The pin function is the same for CN5 and CN6.

Connector CN5 = Connector CN6 = SWITCH

Pin	Ethernet IP
1	TX+
2	RX+
3	TX-
4	RX-

Details about Led status are explained on chapter 5.3

2.8.4 Powerlink (55/---/EPL)

The wirings and LEDs in Figure 12 refer to the Powerlink equipped version.

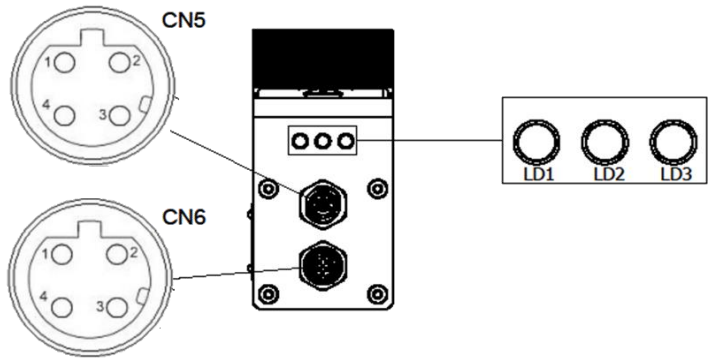


Figure 9

The pin function is the same for CN5 and CN6.

Connector CN5 = Connector CN6 = SWITCH

CN5 connector --- Port A

CN6 connector --- Port B

Pin	Powerlink
1	TX+
2	RX+
3	TX-
4	RX-

Details about Led status are explained on chapter 5.4

2.8.5 Profinet (55/---/EPN)

The wirings and LEDs in Figure 12 refer to the Profinet equipped version.

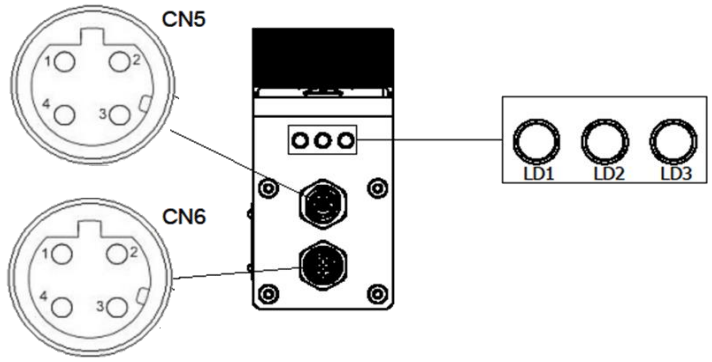


Figure 10

The pin function is the same for CN5 and CN6.

Connector CN5 = Connector CN6 = SWITCH

CN5 connector --- Port

CN6 connector --- Port B

Pin	Profinet
1	TX+
2	RX+
3	TX-
4	RX-

Details about Led status are explained on chapter 5.5

2.9 Protective device installation

In order to prevent short circuits, the product must be connected to a power-supply line protected by devices to protect against overcurrent and short circuits, in compliance with electrical safety legislation, using standard fused, disconnect switches, etc.

For the installation of a switch up line of the power supply connection, we suggest to use isolating switch with slow blow fuse 20A for model DBS 55/-- and 50A for model DBS80/--

3 Parametrization interface

3.1 Software installation

1 Download the “BSI software” e “BSI Usb Driver“ at the following link:

2 https://www.minimotor.com/prodotti/dbs/

3 Extract and run the downloaded files. Follow the installation guide procedure until it is finished.

After the download extract the .zip file and run BSI.exe inside the folder (Figure 11).
WARNING: this is not an installation file. It directly runs the interface software, so you do not need to install it. Cause of this, every time the user wants to use the software only need to double click on this icon.

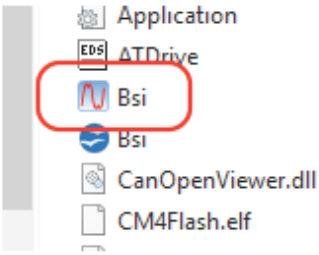


Figure 11

4 Connect the device trough the micro USB to the pc and check that the logic is connected to the power.

5 Once the program is run, select the connection type. If choosing USB, wait for the device to be found and connect. If the DBS is connected via Fieldbus to a net that can exchange data over Ethernet (Ethernet IP, Profinet, Powerlink and EtherCAT with EoE functionality) you can connect typing the DBS IP address. (Figure 12).

Figure 12

6 If the firmware stored in the device is no up to date the screen in Figure12 appears.

Select UPDATE to store the last version of the firmware. **Update is only possible over USB connection**.
Wait for the process to be completed and then click on CLOSE.

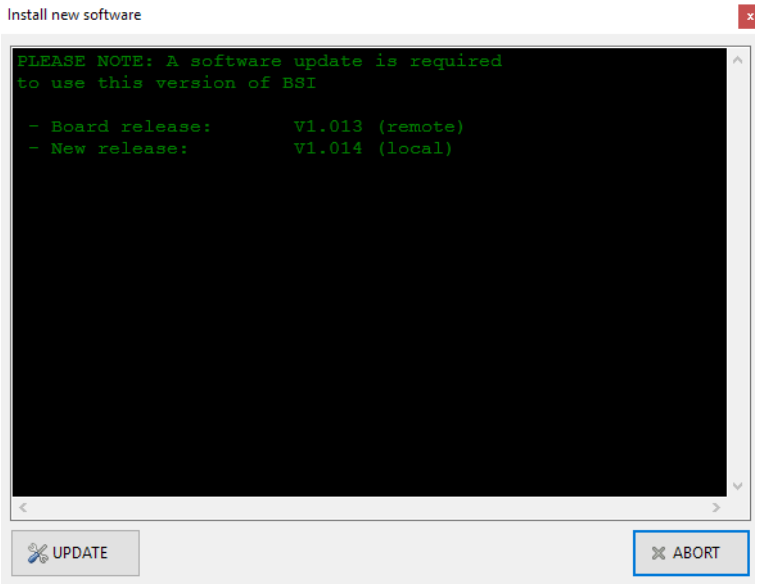


Figure 13

3.2 Software

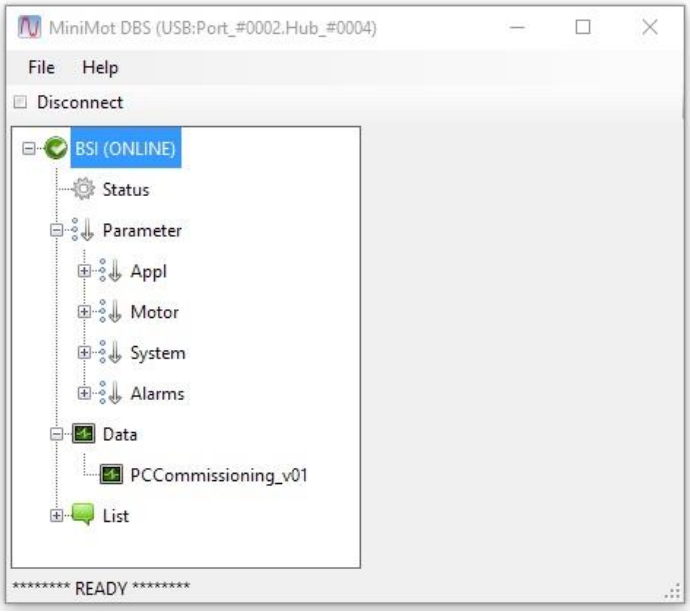


Figure 14

The Figure 14 rapresents the main screen of BSI software.
Following the menu it is possible to act on the motor parameter and to monitor the functional settings.

3.2.1 Status

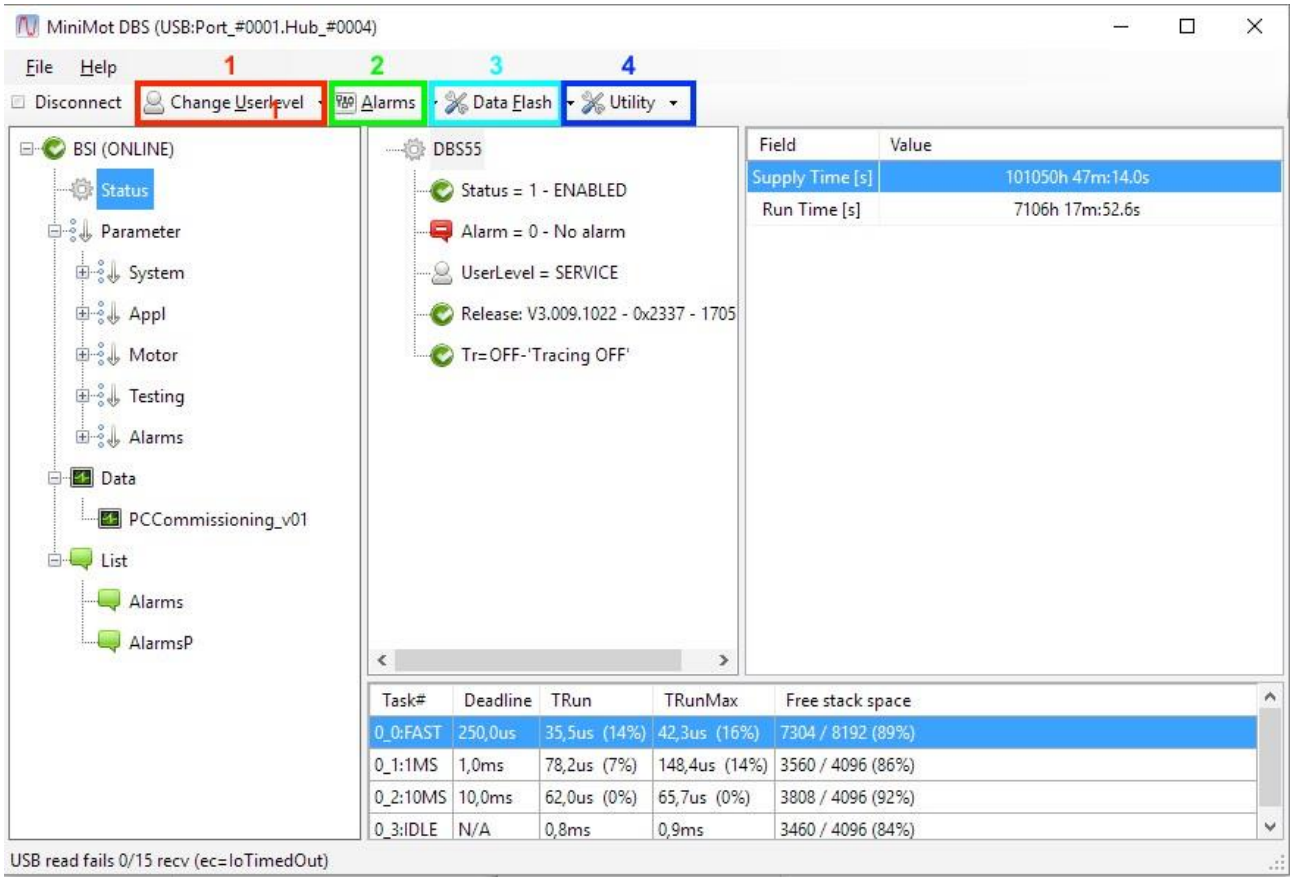


Figure 15

Click on “Status” in order to know the motor status, manage the presence of fault and change the software user level.

1 “Change User Level”: use this option in order to change the software user level and have acces to more setting parameters.

User	Free acces
Advance	Free acces
Eol	PW needed
Service	PW needed

2 “Alarms”: this button gives acces to the alarm menu:

Clear alarms	Reset the alarm situation

3 “Data Flash”: diagnostic tool to save the Flash memory image.;

4 “Utility”: Diagnostic tool.

3.2.2 Alarm list

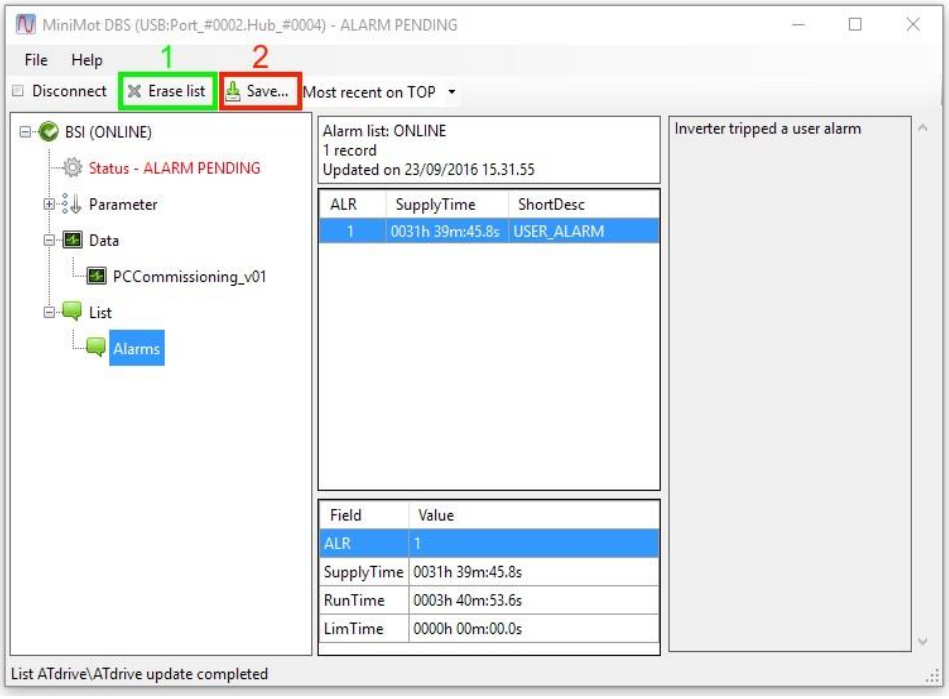


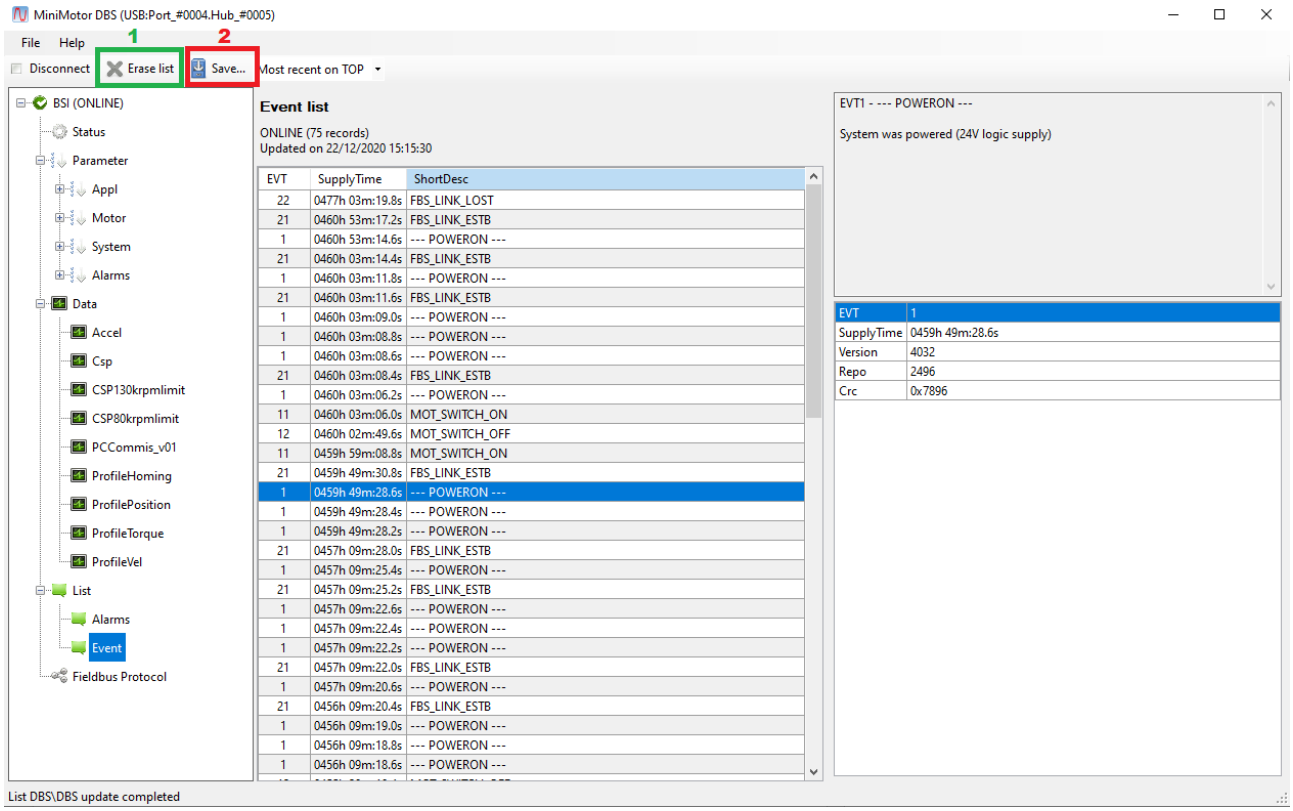
Figure 16

By selecting “list” under the “alarm” voice, it is possible to find the alarm history list.

1 “Erase List”: use this command to erase the hole list.

2 “Save”: use this botton to save the list into an external file.

3.2.3 Event List



Under the “List” category, selecting the Event list it’s possible to see the history of the motor events. There are non critical events.

1 “Erase List”: attraverso questo comando è possibile cancellare lo storico degli eventi

2 “Save”: grazie a questo comando è possibile salvare la lista eventi in un file esterno

3.2.4 Parameter

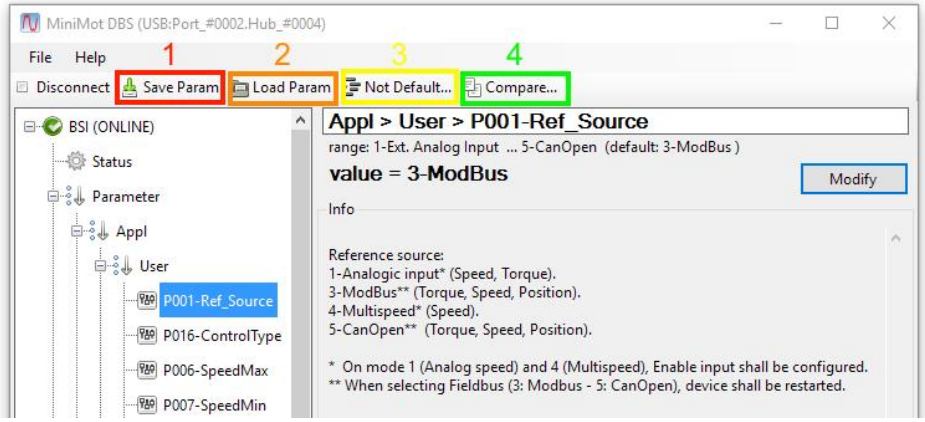


Figure 17

Under “Parameter” it is possible to find and set all the motor parameters.
See the section of this guide in order to understand the meaning of all point and set de desired configuration.

In order to change the value or to select a different voice in one of the parameters, click on modifiy, change the value and then select Update to load the changement Figure 18.

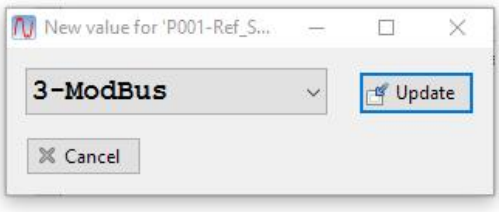


Figure 18

When the voice “parameter” is selected in the top of the window there are several usefull option:

1 “Save Param”: allows to save the parameter setting into an external file.

2 “Load Param”: allows to upload the parameter stored into an external file, directly in the driver storage.

3 “Not default”: shows wich parameter have been changed in respect of the default value.

4 “Compare”: allows to compare the parameter stored in the device with the parameters contained into an external file.

3.2.5 Monitoring

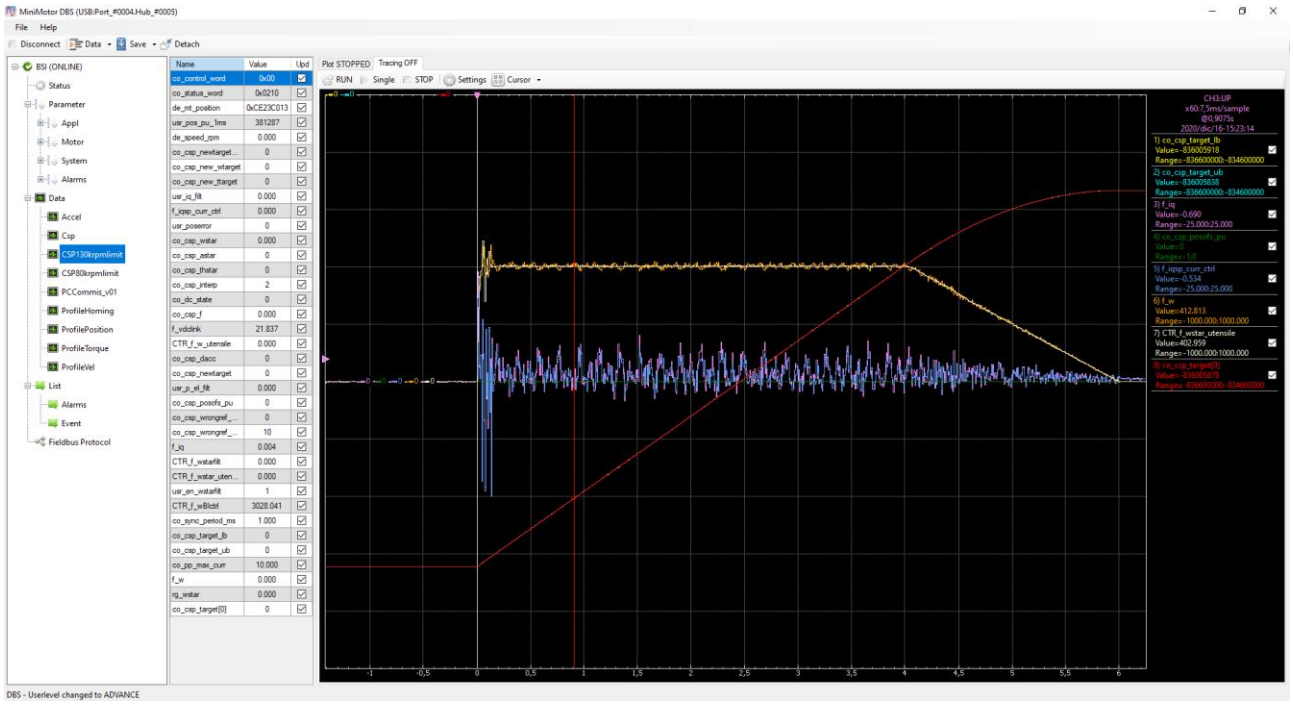


Figure 19

The program BSI is equipped with a tool useful in order to monitor the variables during the motor emplyment. Click on data and select PCCommisioning to see window shown in Figure 19

To activate the control of one or more variables toogle the white square under column “Upd”. The value is represent under the column “Value”.

To use the oscilloscope, open the window settings and set the desired measurement, then click on single in order to obtain the measurement.

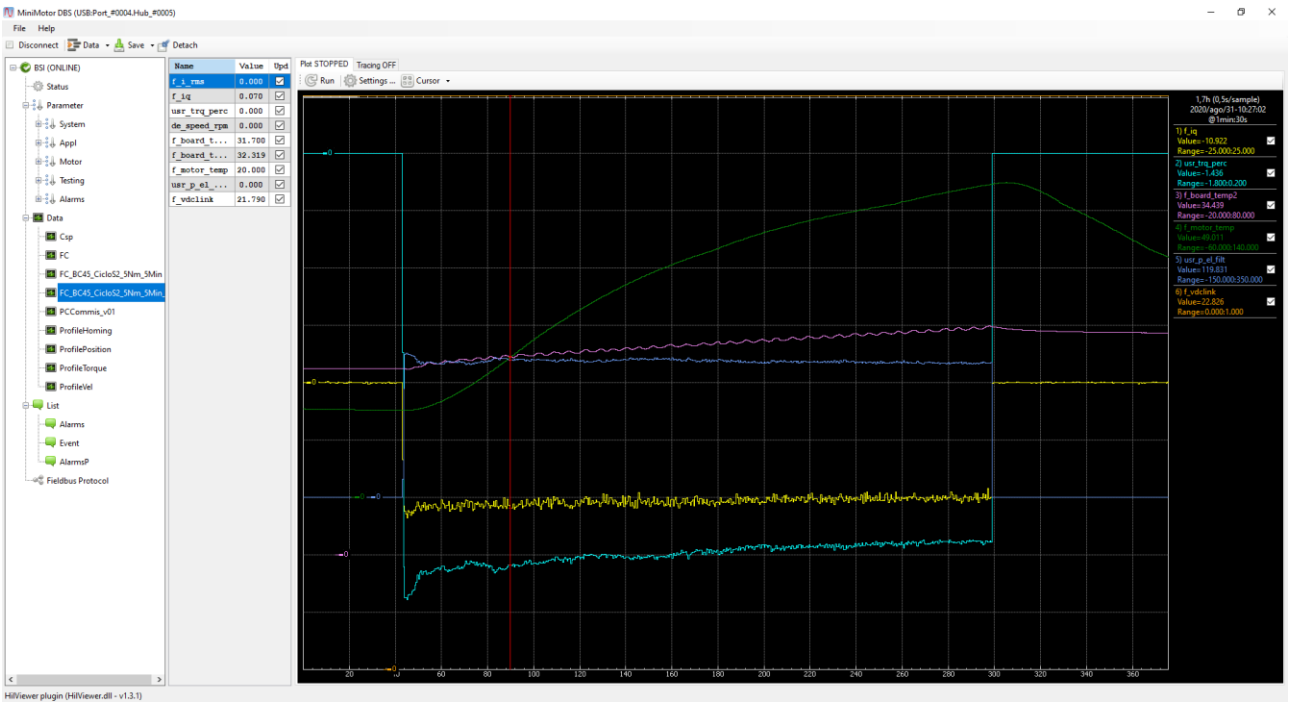


Figure 20

The PLOT function, shown in Figure 20, , enables to track values over longer period of time.

4 Parameters

All Parameters are shown at the Advance user level.

4.1 Appl

4.1.1 User

ID	NAME	DESCRIPTION	NOTE		
P001	MODE	Reference source selection	1	Speed Analog Input[1]	Speed
			2	ModBus + Dig.Input[1]	Speed, Torque, Position, Homing
			3	ModBus	Speed, Torque, Position, Homing
			4	Multispeed[1]	Speed
			5	CanOpen[2]	Speed, Torque, Position, Homing
			6	CanOverECAT[2]	Speed, Torque, Position, Homing
			7	Ethernet PowerLink[2]	Speed, Torque, Position, Homing
			8	Ethernet/IP[2]	Speed, Torque, Position, Homing
			9	Profinet IO[2]	Speed, Torque, Position, Homing
			10	CanOverAir[2]	Speed, Torque, Position, Homing
			11	TrqAnalogIn[1]	Torque
			12	MultiTrq[1]	Torque
			13	MultiPos[1]	Position
			14	Ain Speed + Modbus	Speed, Torque, Position, Homing
			[1] In MODE 1, 2, 4, 11, 12 and 13 there must be at least one input as Enable. [2]Reboot is necessary when switching between modes.		
P006	Speed Max	Max speed reference	0 ÷ 6000 [rpm]		
P007	Speed Min	Minimum speed ref Analog mode	0 ÷ 4000 [rpm]		
P008	Ramp Acc	Acceleration for speed/position control	1 ÷ 120000 [rpm/s]		
P009	Ramp dec	Deceleration for speed/position control	1 ÷ 120000 [rpm/s]		
P017	IMax	Maximum operative current	0 ÷ 22.1 / 18.7 [A] (55-50 / 55-100)		
P021	MotorChangeDir[1]		1	None	Disable

		Parameter to change the direction of motor	2	Inverted	Inverted the rotation
			[1] Only if P001=1,4,11,12 or 13		

4.1.2 Input Output

ID	NAME	DESCRIPTION	NOTE		
Analog					
P004	MinRefAnalog	Min analog reference	[0.0% ÷ 100.0%]		
P005	MaxRefAnalog	Max analog reference	[0.0% ÷ 100.0%]		
P043	AinMode	Set the analog input function	0	Voltage ref input	0÷10 [V]
			1	Voltage ref input	-10÷10 [V]
			2	Current ref input	0÷20 [mA]
			3	Current ref input	4÷20 [mA]
			WARNING: mode 2 and 3 are on request specified in the order (MA option).		
P045	AinOffs	Offset correction for analog input	-10÷10 [V]		
P046	AinGain	Gain correction for analog input	0.000÷2.000		
P047	AinThre	Ain Threshold, as percentage	0.0÷100.0 [%]		
Digital Input					
P010	InputFunc1	Digital input function 1: Enable the digital control of the digital pnp input 1. Define the function controlled by the digital input 1.	0	Not Used	
			1	Enable/Stand-By[2]	
			2	Run/Stop[2]	
			3	Run Edge Triggered)[2]	
			4	Stop (Edge Triggered)[2]	
			5	Forward/Reverse[2]	
			6	Run/Stop Forward[2]	
			7	Run/Stop Reverse[2]	
			8	Error Reset	
			9	User Error	
			10	Multispeed Binary Selection, Bit 0[2]	
			11	Multispeed Binary Selection, Bit 1[2]	
			12	Multispeed Binary Selection, Bit 2[2]	
			14	Brake Unlock	
			15	CollisionSignal[2]	
			29	Homing Start	
			30	Home Switch[1]	
			31	Fwd Limit Switch[1]	
			32	Rev Limit Switch[1]	
			[1] Available in homing mode and local modes [2] Available only if P001=1,4,11,12 or 13.		
P011	InputFunc2	Digital input function 2	See P010		
P012	InputFunc3	Digital input function 3	See P010 / STO 1 (Optional on request specified in the order)		

P013	InputFunc4	Digital input function 4	See P010 / STO 2 (Optional on request specified in the order)		
P014	InputFunc5	Digital input function 5	See P010		
P032	AinFunc	Digital input associated to Analog Input	See P10		
P020	DiglnInvMask	Defines the Active low or high status of the digital inputs	Example: 0b00001 Digital input 1 Active low 0b00101 Digital inputs 1 and 3 Active low		
Digital Output					
P015	OutFunc	Digital output. Defines what activates the motor output signal.	0	Always Off	
			1	Ready	
			8	Error	
			9	Target Reached	
P064	TargReachedHyst	Defines the window within the event “target reach” has to happen.	Speed	[rpm]	0 ÷ 9999
			Torque	[mA]	
			Position	[step]	
P065	TargReachHyst Time	Defines the time whiten the event “target reach” has to be completed.	[0 ÷ 9999] [ms]		

4.1.3 Accelerometer

The Accelerometer Function is optional on request, supported by default on UR Compliant Motors.

ID	NAME	DESCRIPTION	NOTE
P035	Endscale	Defines the Accelerometer End-Scale	2 – 4 – 8 [G]
P036	DataRate	Defines Accelerometer Output Rate	10-50-100-200-400-800 [Hz]
P037	RmsTau	Defines the time filter constant for RMS computation of the accelerations	1 ÷ 1000 [ms]
P038	EventLevel	Defines the level of acceleration that triggers logging for over-acceleration event	0.1 ÷ 10 [G]
P039	EventTime	Defines the time filter constant for logging and over-acceleration event	1 ÷ 1000 [ms]
P040	EventInhibit	Defines the inhibition time for logging a second over-acceleration event	1 ÷ 2400 [minuti]

4.1.4 MultiTrq

Torque presets for multorque mode

ID	NAME	DESCRIPTION	NOTE
P102	Multitorque1	Defines the torque presets for the binary combinations of MultiTorque mode. In Multispeed/MultiPosition it works as torque limit for the corresponding profile.	-200 ÷ +200 [% nominal]
P103	Multitorque2		
P104	Multitorque3		
P105	Multitorque4		
P106	Multitorque5		

P107	Multitorque6	Only with P001=4,12,13	
P108	Multitorque7		
P109	Multitorque8		

4.1.5 MultiSpeed

Speed presets for multispeed mode.

ID	NAME	DESCRIPTION	NOTE
P110	Multispeed1	Defines the speed presets for the binary combinations of MultiSpeed mode. In MultiTorque/MultiPosition it works as speed limit for the corresponding profile. Only with P001=4,12,13	-6000 ÷ 6000 [rpm]
P111	Multispeed2		
P112	Multispeed3		
P113	Multispeed4		
P114	Multispeed5		
P115	Multispeed6		
P116	Multispeed7		
P117	Multispeed8		

4.1.6 MultiPos

Position presets for multiposition mode

ID	NAME	DESCRIPTION	NOTE
P120	Multiposition1	Defines the position presets for the binary combinations of MultiPosition mode. Only with P001=13	-2147483648 ÷ +2147483647 [user units]
P122	Multiposition2		
P124	Multiposition3		
P126	Multiposition4		
P128	Multiposition5		
P132	Multiposition6		
P134	Multiposition7		
P135	Multiposition8		

4.1.7 MultiPos_Mode

Multipositioning mode behaviour.

ID	NAME	DESCRIPTION	NOTE	
P221	Multiposref1_mode	Defines the logic behind the positioning, if they have to be absolute positioning, relative or additive. Solo con P001=13	0	Absolute
P222	Multiposref2_mode			
P223	Multiposref3_mode		1	Relative
P224	Multiposref4_mode			
P225	Multiposref5_mode		2	Additive
P226	Multiposref6_mode			
P228	Multiposref8_mode			

4.1.8 Homing

ID	NAME	DESCRIPTION	NOTE
P152	HomingType	Defines the homing type according to the CanOpen CIA402 standard.	Available Homing: 1 ÷ 14

		See section 11.	33 - 34 - 37	
P153	HomingSwitchSpeed	Defines the speed used to search the home or limit switch	0 ÷ 4000 [rpm]	
P154	HomingIndexSpeed	Defines the positioning speed at the index pulse	0 ÷ 4000 [rpm]	
P155	HomingAccel	Defines the motor acceleration used to reach the settled homing speed starting by stop position	0 ÷ 10000 [rpm/s]	
P156	HomingDecel	Defines the deceleration used to stop the motor running at the homing speed	0 ÷ 10000 [rpm/s]	
P157	HomingTimeOut	Defines the time limit for the data exchange during the homing process. After it, homing error is generated.	1 ÷ 200 [s]	
P158	HomingMaxCurr	Defines the limit to the motor current available during the homing	0.001 ÷ 10 [A]	
P159	HomingEnable	This function allows to enable or disable the homing	0	DISABLE
			1	ENABLE
P168	HomingOffsetLOW	Defines the offset value taken into account during the homing. The value is generated by one Low Word and one HighWord	Example: Offset =68000 (dec) = 0x109A0 (hex) P169 = 0x0001 P168=09A0 Offset = -1000 (dec) FFFFFC18 (hex) P169= 0XFFFF P168=0xFC18	
P169	HomingOffsetHIG			

4.1.9 Fieldbus

ID	NAME	DESCRIPTION	NOTE	
Position Scaling				
P160	PosFactorNum	Defines the numerator used to calculate the scaling factor (position factor) used to represent the position in user defined unit. See 8.1.3 section.	0 ÷ 32767	
P161	PosFactorDen	Defines the denumerator used to calculate the scaling factor (position factor) used to represent the position in user defined unit. See 8.1.3 section.	0 ÷ 32767	
P162	PosFactorDecimal	Defines the number of decimal places used to represent the profile unit.	0 ÷ 32767	
P163	UserPosInversion	Allows the user to invert the count of the encoder on the basis of the motor rotational direction.	None	Positive count CW rotation
			Inverted	Negative count CCW rotation
EthernetIP*				
P170	IpAddr	Allows to set the slave address of the motor using Ethernet/IP	192.168.250.100	
P172	IpMask	Defines the Ethernet/IP	255.255.0.0	

P174	IpGateway	Defines the Ethernet/IP	0.0.0.0			
P176	ProcDataLayout	Set default or extended process data for EIP and Profinet	0 Default 1 Extended_A (D I/O) 2 Extended_B (Touch probe 402) 3 Extended_C (Touch probe MM) 4 Extemded_D (Accelerometer)			
P177	SpeedUnitMode	Speed and acceleration object scaling	0 RPM – RPM/s 1 Increments/s – Increments/s^2			
Modbus						
P182	ModbusAddress	Allows to set the slave address of the motor, connected through RS458 serial line using Modbus protocol	1 ÷ 500			
P183	ModbusMode	Defines the Modbus RTU protocol configuration: - Modbus Word number of bits - Parity bit (None, Odd, Even) - Number of stop bits	Value	Word	Parity	Stop
			8-N-2	8bit	none	2bits
			8-E-2	8bit	even	1bits
			8-O-1	8bit	odd	1bits
P184	ModbusBaudrate	Defines the Baudrate for the Modbus protocol communication	0	9.6	[Kbaud]	
			1	19.2		
			2	38.4		
			3	57.6		
			4	115.2		
CanOpen						
P191	CanOPEN_Nodeid	Defines the address (bus node) that defines the device.	1 ÷ 127			
P192	CanOPEN_Baudrate	Defines the device Baudrate for the CanOPEN protocol communication	1	20	[Kbaud]	
			2	50		
			3	125		
			4	250		
			5	500		
			6	1	[Mbaud]	
P193	CanOPEN_GuardTime	Defines the NMT Guard Time	0 – 1000 [ms] The value 0 disables the functionality			
P194	CanOPEN_LifeFactor	Defines the NMT Life Factor	0 -50 The value 0 disables the functionality			
Ecat (EtherCAT)*						
P195	StationAddress	Defines the default station adress	0 ÷ 32767			
P198	ProductCsp	Set the EtherCAT product-id (and relative configuration) for the device	0	PROFILE		
			1	CSP		
CSP (Cyclic Synchornous Positioning)						
P178	WrongRefDelay	Delay of CSP position reference consistency	0 ÷ 1000 ms			
P179	WrongRefBeh		0	NO ACTION		

		Behaviour of CSP position target protection	1	CORRECT
			2	ALARM
P180	AccelMax	Acceleration limit for CSP pos. Ref.	1 ÷ 3000 krpm/s	
P190	CSP_FF_Mode	CSP feedfoward speed mode	1	Offset 60B1.0
			2	Computed
PowerLink*				
P197	NodeId	Defines the default Node-ID for PowerLink node	0 ÷ 32767	
ProfinetIO*				
P199	ByteOrder	Set the byte order style	Little/Big endian	

4.2 Motor

ID	NAME	DESCRIPTION	NOTE
P022	BrakeDeactTime	Deactivation time of brake AFTER motor control start	[ms]
P023	BrakeActTime	Activation time of brake BEFORE motor control stop	[ms]

4.2.1 Temperature

ID	NAME	DESCRIPTION	NOTE
P028	MotorTempMAX	Defines the maximum motor temperature. Exceeded this value over temperature alarm appears. This parameter is active only if NTC present on the motor and active.	[°C]
P029	Motor TempRecover	Defines the minimum motor temperature. Exceeded this value over temperature alarm appears. This parameter is active only if NTC present on the motor and active.	[°C]

4.2.2 Control

ID	NAME	DESCRIPTION	NOTE
Speed			
P237	KpSpeed	Defines the proportional gain in PI speed control	0 ÷ 3.2000
P238	kiSpeed	Defines the integral gain in speed PI control	0 ÷ 3.2000
Position			
P253	kpPos	Defines the proportional gain in P position control	0 ÷ 3.2000

4.2.3 Encoder

ID	NAME	DESCRIPTION	NOTE
P252	EncLPFTau	Defines the time constant considered in the low-pass filter used to filter the speed measures from the encoder	0.001 ÷ 1.000 [s]

4.3 System

ID	NAME	DESCRIPTION	NOTE	
P082	UndervoltMode	Dedice when to signal undervolt error	0 – Only when engine is on 1 - Always	
P083	Enable5VFeedback	Power Supply logic	0 – Software 1 – Hardware	
P202	StartUL	Define the user level at program start-up.	User	Free acces
			Advance	Free access
			Eol	PW needed
			Service	PW needed

4.4 Alarm

ID	NAME	DESCRIPTION	NOTE
P210	Nreset	Defines the number of autoresettable alarm event exceeded which the fault is generated	0 ÷ 100
P211	TminReset	Defines the time after which the alarm ca be autoresetted	0.5 ÷ 30 [s]
P212	Trestore	Defines the time after which the autoresettable alarm count is resetted	0.5 ÷ 1800 [s]

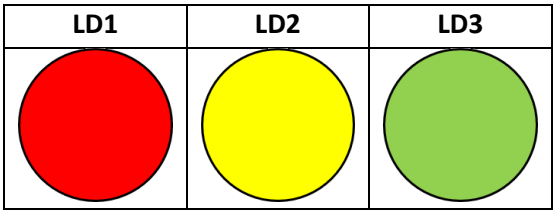
*Changes are applied on reboot of the device

5 LED status

LED color and operating modes (flashing / powering mode) depend on the fieldbus expansion Board mounted (i.e. CanOpen, Ethercat, etc).

5.1 Fieldbus Board CanOpen\Modbus

The indication LEDs are three and they are mapped on the drive's LEDs in the following way:



LED mapping on the drive

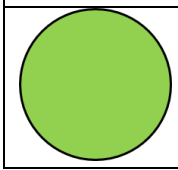
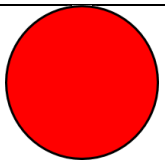
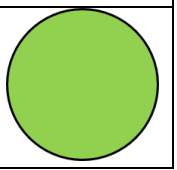
LED	Indication (*)	Status
LD1	FLASHING (Red)	**Inverter alarm** Tacc=0.5s Tperiod=1s
	FLASHING (Red)	**PWM off** The number of flashes represent the type of control set: • 0 flashes: unchecked control; • 1 flash: torque control; • 2 flashes: speed control; • 3 flashes: position control.
	ON (Red)	**PWM on**
LD2	OFF	**Yellow led always off**
LD3	OFF	**Inverter alarm**
	FLASHING (Green)	**PWM off** The number of flashes represents the source of the reference: • 1 flash: Analog reference; • 3 flashes: Modbus reference; • 4 flashes: Multispeed reference; • 5 flashes: reference via CanOpen.
	ON (Green)	**PWM on** (Intermittent speed proportional to the rotation speed in relation to P006 parameter)

5.2 Fieldbus Board EtherCAT

The indication LEDs are two:

LD1	RUN/ERR (Run/Error)	Run stuats of the EtherCat slave.	Bicolour LED Green/Red
LD2	ERR	Error status of the Ethercat slave	Red LED
LD3	L/A IN (Link/Activity input)	Represents the link status ("L", LINK) and Tx / Rx ("A", ACT) data link traffic of Ethernet communication input ("in") to the Ethercat slave (green)	LED Green

and they are mapped on the drive's LEDs in the following way:

LD1	**LD2**	**LD3**
RUN/ERR		L/A IN
		

LED mapping on the drive

LED		**Indication** (*)	**Status**
LD1	**RUN**	OFF ○	**INIT**
		ON (Green) ●	**OPERATIONAL**
		BLINKING (2.5 Hz Green) ☀	**PRE-OPERATIONAL:** the device is in "**pre-operational"** mode.
		SINGLE FLASH (Green) ☀	**SAFE-OPERATIONAL:** the device is in "**safe operational"** mode.
LD2	**ERR**	OFF ○	**No Error:** the communication works properly.
		BLINKING (2.5 Hz, Red) ☀	**Invalid configuration:** General Configuration Error Possible reason: State change commanded by master is impossible due to register or object settings.
		SINGLE FLASH (Red) ☀	**Local error:** Slave device application has changed the EtherCAT state autonomously. Possible reason 1: A host watchdog timeout has occurred. Possible reason 2: Synchronization Error, device enters Safe-Operational automatically.
		RED (double flash)	**Application watchdog timeout:** An application watchdog timeout has occurred. Possible reason: Sync Manager Watchdog timeout.

			
LD3	**L/A IN**	OFF 	**No connection:** The device has no link to the Ethernet.
		ON (Green) 	Connected: The device is linked to the Ethernet, but does not send/receive Ethernet frames.
		FLICKERING (Load dependent, Green) 	Activity: The device is linked to the Ethernet and sends/receives Ethernet frames.

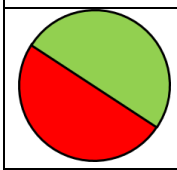
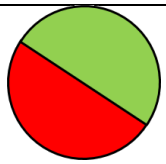
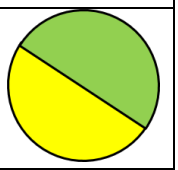
Indicator states	**Definition**
ON	Constantly on
OFF	Constantly off
SINGLE FLASH	The indicator shows one short flash (200 ms) followed by a long “off“ phase (1,000 ms).
DOUBLE FLASH	The indicator shows a sequence of two short flashes (each 200 ms), separated by a short off phase (200 ms). The sequence is finished by a long off phase (1,000 ms).
BLINKING (2.5 HZ)	The indicator turns on and off with a frequency of 2.5 Hz: “on” for 200 ms, followed by “off” for 200 ms.
FLICKERING (LOAD DEMPENDENT)	The indicator turns on and off with a frequency of approximately 10 Hz to indicate high Ethernet activity: on for approximately 50 ms, followed by off for 50 ms. The indicator turns on and off in irregular intervals to indicate low Ethernet activity.

5.3 Fieldbus Board Ethernet IP

The indication LEDs are three:

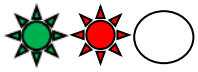
LD1	MS (Modul Status)	Represents the operating state of the Drive seen as an EthernetIP adapter	Bicolour LED Green/Red
LD2	NS (Network Status)	Represents the network connection status of the Drive Ethernet IP Adapter.	Bicolour LED Green/Red
LD3	L/A IN (Link / Activity input)	Represents the link status ("L", LINK) and Tx / Rx ("A", ACT) data link traffic of Ethernet communication input ("in") to the Ethercat slave (Green)	Bicolour LED Green/Yellow

and they are mapped on the drive's LEDs in the following way:

LD1	**LD2**	**LD3**
MS	NS	L/A IN
		

LED mapping on the drive

LED		**Indication** (*)	**Status**
LD1	**MS**	OFF 	**No power:** the device is powered off.
		ON 	**Device operational:** If the device is operating correctly.
		FLASHING (1Hz) 	**Standby:** The device has not been configured.
		ON (Red) 	**Major unrecoverable fault:** The device has detected a non-recoverable major fault.
		BLINKING (1Hz) 	**Major recoverable fault:** If the device has detected a majore recoverable fault. NOTE: An incorrect or inconsistent configuration would be considered a major recoverable fault.
		FLASHING (Green/Red/Green) 	**Self-test:** While the device is performing its power up testing, the module status indicator shall be flashing green/red/green • Network Status Led off. • Module status LED turns green for approximately 250ms, turn red for 250 ms, and again turns green until the power up test has completed. • Module status LED turns green for approximately 250ms, turn red for 250 ms, and turns off until the power up test has completed.

LD2	**NS**	OFF 	**Not powered, no IP address:** The device doesn't have an IP address (or is powered off).
		ON 	**Connected**: An IP address is configured, at least one CIP connection (any transport class) is established device has at least one established, and an Exclusive Owner connection has not timed out.
		BLINKING (1Hz) 	**No connections**: The device has obtained an IP address, the network; and no CIP connection are established and an exclusive Owner connection has not timed out.
		ON 	**Duplicate IP**: The device has detected that its IP address is already in use.
		BLINKING (1Hz) 	**Connection timeout:** An IP address is configured, and an Exclusive Owner connection for wich the device is the target has timed out. The network status indicator returns to steady green only when all timed out Exclusive Owner connections are restablished.
		FLASHING (Green/Red/off) 	**Self test**: Thedevice is performing its power-up testing. Refer to description for module status LED self-test.
LD3	**LINK**	OFF 	**No connection:** The Ethernet link isn't established
		ON 	**Connection OK**: The device is linked to the Ethernet.
	ACT	FLASHING 	**Activity:** The device sends/receives Ethernet frames.
		OFF 	**No Activity:** The device does not send/receive Ethernet frames.

(*) Definition of LED's timings

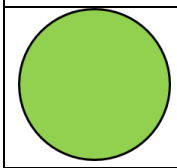
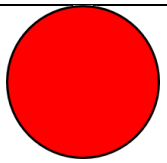
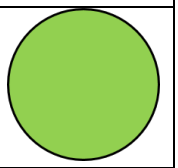
Indicator states	Definition
ON	Constantly on
OFF	Constantly off
BLINKING (1HZ)	The indicator shall turn on and off iso-phase with a frequency of 2.5 Hz: on for 200ms followed by off for 200ms
FLICKERING (LOAD DEMPENDENT)	The indicator turns on and off with a frequency of approximately 10 Hz to indicate high Ethernet activity: on for approximately 50 ms, followed by off for 50 ms. The indicator turns on and off in irregular intervals to indicate low Ethernet activity.

5.4 Fieldbus Board Ethernet PowerLink

The indication LEDs are three:

LD1	BS	Bus status	LED Green
LD2	BE	Bus error	LED Red
LD3	L/A	Ethernet Status (Link activity)	LED Green

and they are mapped on the drive's LEDs in the following way:

LD1	**LD2**	**LD3**
BS	BE	L/A
		

LED mapping on the drive

LED		**Indication** (*)	**Status**
LD1	**BS**	OFF 	**No power:** If the device does not have an IP address (or is powered off), the network status indicator shall be steady off.
		ON (Green) 	**Operational:** Slave is in **'Operational'** state.
		TRIPLE FLASH (Green) 	**ReadyToOperate**: Slave is in '**ReadyToOperate'** state.
		DOUBLE FLASH (Green) 	**Pre-Operational 2**: Slave is in '**Pre-Operational 2**' state.
		SINGLE FLASH (Green) 	**Pre-Operational 1:** Slave is in **'Pre-Operational 1'** state.
		FLICKERING (10Hz) 	**Basic Ethernet**: Slave is in **'Basic Ethernet'** state.
		BLINKING (Green) 	**Stopped: Slave is in "**Stopped slave"

LD2	**BE**	OFF 	**No error:** Slave has no error.
		ON (Red) 	**Error:** Slave has detected error.
LD3	**L/A**	OFF 	**No connection:** The device has no link to the Ethernet
		ON (Green) 	**Link**: The device is linked to the Ethernet, but does not send/receive Ethernet frames.
		FLICKERING (Green) 	**Activity**: The device is linked to the Ethernet and sends/receives Ethernet frames.

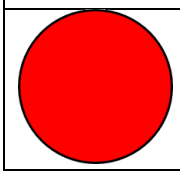
Indicator states	**Definition**
ON	Constantly on
OFF	Constantly off
BLINKING (2.5HZ)	The indicator shall turn on and off iso-phase with a frequency of 2.5 Hz: on for 200ms followed by off for 200ms
TRIPLE FLASH	The indicator shows a sequence of three short flashes (each 200 ms), separated by a short off phase (200 ms). The sequence is finished by a long “Off” phase (1,000 ms).
DOUBLE FLASH	The indicator shows a sequence of two short flashes (each 200 ms), separated by a short off phase (200 ms). The sequence is finished by a long “off” phase (1,000 ms).
SINGLE FLASH	The indicator shows one short flash (200 ms) followed by a long “off” phase (1,000 ms).
FLICKERING (10HZ)	The indicator turns on and off with a frequency of 10 Hz: “on” for 50 ms, followed by “off” for 50 ms. The red LED and the green LED are switched on alternately.
FLICKERING (LOAD DEMPENDENT)	The indicator turns on and off with a frequency of approximately 10 Hz to indicate high Ethernet activity: on for approximately 50 ms, followed by off for 50 ms. The indicator turns on and off in irregular intervals to indicate low Ethernet activity.

5.5 Fieldbus Board Ethernet ProfiNet IO

The indication LEDs are three:

LD1	SF	System Failure	RED LED
LD2	BF	Bus Failure	RED LED
LD3	L/RX/TX	(Link / RX-TX Activity)	Bicolour LED

and they are mapped on the drive's LEDs in the following way:

LD1	**LD2**	**LD3**
SF	BF	L/RX/TX
		

LED mapping on the drive

LED		**Indication** (*)	**Status**
LD1	**SF**	OFF 	**No error**
		ON (Red) 	**Error** Watchdog timeout; channel, generic or extended diagnosis present; system error
		FLASHING (Red, 1Hz, 3 s) 	**DCP signal service** is initiated via the bus
LD2	**BF**	OFF 	**No error**
		ON (Red) 	**Error:** No configuration or low speed physical link; or no physical link
		FLASHING (2 Hz Red) 	No data exchange
LD3	**LINK**	OFF 	**No connection:** The device has no connection to the Ethernet.
		ON (Green) 	**Link**: A connection is linket to the Ethernet
	RX/TX	FLICKERING (Load dependent, Yellow) 	**Activity**: A connection to the Ethernet exists.
		OFF 	**No Activity:** The device does not send/receive Ethernet frames.

Indicator states	Definition
ON	Constantly on
OFF	Constantly off
FLASHING (1 HZ, 3 S)	The indicator turns on and off for 3 seconds with a frequency of 1 Hz: “on” for 500 ms, followed by “off” for 500 ms.
FLASHING (2 HZ)	The indicator turns on and off with a frequency of 2 Hz: “on” for 250 ms, followed by “off” for 250 ms.
FLICKERING (LOAD DEMPENDENT)	The indicator turns on and off with a frequency of approximately 10 Hz to indicate high Ethernet activity: "on" for approximately 50 ms, followed by "off" for 50 ms. The indicator turns on and off in irregular intervals to indicate low Ethernet activity.

6 Alarm

ID	NAME	DESCRIPTION	
0	NONE	No alarm	
1	USER	User alarm	
2	DATAFLASH	Data flash error	
3	OVERVOLT	overvoltage	autoresettable
4	OVERCURR_HW[1]	overcurrent hardware	autoresettable
5	OVERCURR_SW[1]	overcurrent software	autoresettable
6	OVERTEMP_BOARD[1]	Board overtemperature	autoresettable
7	OVERTEMP_MOTOR[1]	Motor overtemperature	autoresettable
8	ENC_SPI_COMM	encoder SPI communication error	autoresettable
9	UNDERVOLT	Undervoltage	autoresettable
11	MDB_WATCHDOG	Modbus Watchdog alarm	
20	PARAM_ERROR	Parameter storage not available or damaged	
21	PARAM_VAL_ERROR	Wrong value parameter	
22	PARAM_RESTORE_DEFAULT	Restore parameter default error	
23	MOTOR_PARAM_RESTORE_DEFAULT	Restore motor parameter default error	
90	EXT_DIG	User alarm generated by digital input	
91	APPL_SWITCH_CONSISTENCY	Homing switch error	
92	APPL_MOT_UNDEFINED	Motor type not selected	
101	CSP_SYNC	Error in the CSP Synchronization	
102	CSP_WRONGREF	Error in the CSP reference position	
105	1MS_OVERRUN	Task 1ms exceeded the deadline real-time	
106	10MS_OVERRUN	Task 10ms exceeded the deadline real-time	
107	FB_BOARD_MISMATCH	Fieldbus board mismatched	
108	FB_BOARD_FAILURE	Fieldbus board not correctly initialized	
109	FB_SEC_MEMORY	Fieldbus board’s secury memory not working	
110	FB_APP_FAILURE	Fieldbus mode not compatible with hardware	
120	WL_BOARD_FAILURE	Wireless Board not working	
150	WRONG_HOMING_PROCEDURE	Homing error	
151	TIMEOUT_HOMING	Timeout Homing Error	
200	PMSM_ENCNOTALIGNED	Encoder not aligned	
201	PMSM_ENCALRMOTION	Encoder cannot detect the moving	
202	PMSM_ENCALRVERSO	Wrong encoder direction	
203* 	PMSM_ENCSPI_MT	Multi turn encoder error. The multiturn position is not relieable.	autoressettable
204	PMSM_ENCSPI_ST	Single turn encoder error. The singleurn position is not relieable.	autoressettable
210	ELPARAUTOTUNE_TIMEOUT	time-out auto tuning error	

*  The multiturn position is not reliable, so is mandatory to make a homing procedure.

Autoresettable error, see parameter P210, P212, P211.

6.1 Events

ID	NAME	DESCRIPTION
1	STARTUP	System restarted
2	USER	User event
3	ACCMAX_REACHED	Acceleration Limit reached
11	MOT_SWITCH_ON	Motor was switched on by user
12	MOT_SWITCH_OFF	Motor was switched off by user
13	MOT_SWITCH_OFF_ALR	Motor was switched off by an alarm
21	FBS_LINK_ESTB	Fieldbus Link Estableshed
22	FBS_LINK_LOST	Fieldbus Link Lost
23	FBS_UPTIME_DSC_VHIGH	Netx time discontinuity
24	FBS_UPTIME_DSC_VLOW	Netx time discontinuity with low voltage
25	FBS_UPTIME_DSC_KO	Netx time discontinuity (not responding)

7 Modbus register

Note: Available only in CanOpen/Modbus RTU driver version (DBS55/---/C)

**** Update to DBS55 V4.032 ****

7.1 Read and write register

ID	NAME	DESCRIPTION	NOTE	
3	Control type	Available motor control type RW 16-bit unsigned integer Equivalent to P016 parameter	0	None
			1	Torque
			2	Speed
			3	Position
20	Watchdog time	Watchdog time (ms) RW 16-bit unsigned integer Default value: 0	• If value is set to zero (default register value) watchdog is disabled. • When a value between 100ms to 65000ms is set, if no read or write operation is sent within this time, register 840 is cleared and alarm MODBUS_WATCHDOG is triggered Note: setting value from 1ms to 99ms range will anyway set the timeout as 100ms (is not possibile to set a timeout less than 100ms)	
840	Run and direction	Enable the drive and set the rotating direction RW 16-bit unsigned integer Equivalent to P021 parameter	Bit 0	0 Not enable
				1 Enable
			Bit 1	0 Forward
				1 Reverse
829	Last alarm/ clear alarm list	Shows the last alarm stored and allows to clear the entire alarm list RW 16-bit unsigned integer	Read Write = 0	Las alarm Clear alarm list
843	Alarm reset	Allows to reset the alarm RW 16-bit unsigned integer	0	No reset
			0 → 1	Clear on rising edge
4144	Actual alarm	Shows the actual error code See error description in section 5.4		
4177	Enable write params	Enables writing the settled parameters in the flash memory making them permanent.	0	Parameter storing disabled
			0 → 1	Paramenter changes are stored

Torque control			
11	Max current	Maximum motor current in torque control RW 16-bit unsigned integer Equivalent to P017 parameter	0 ÷ 20000 [mA]
16	Max acceleration	Maximum acceleration in speed/position control RW 16-bit unsigned integer Equivalent to P008 parameter	1 ÷ 15000 [rpm/s]
17	Max deceleration	Maximum deceleration in speed/position control RW 16-bit unsigned integer Equivalent to P009 parameter	1 ÷ 15000 [rpm/s]
Speed Control			
841	Speed target	Define the motor target speed RW 16-bit signed integer	[rpm]
Position Control			
844 - 845	Position target	Defines the target position RW 32-bit signed integer	[User Unit]

7.2 Read only register

ID	NOME	DESCRIZIONE	NOTE
801	Motor Speed	Shows the actual motor speed R 16-bit signed integer	[rpm]
802	Motor RMS Current	Shows the RMS current absorbed by the motor R 16-bit signed integer	[Arms*0.1]
804	Power supply voltage	Shows the DC motor bus voltage R 16-bit unsigned integer	[V*0.1]
805	Motor voltage supply	Shows the RMS voltage on the motor R 16-bit signed integer	[Vrms*0.1]
806	Motor temperature	Shows the motor temperature R 16-bit signed integer	[0.1°C]
808 - 809	Motor position	Shows the actual motor position R 32-bit signed integer	[User Unit]

810	Motor direction	Shows the rotating direction of the motor R 16-bit signed integer	0	Forward
			1	Reverse
812	Analog input value	R 16-bit signed integer		
815	Board temperature Sensor 1	Shows the board temperature R 16-bit signed integer		[0.1°C]
816	Board temperature Sensor 2	Shows the board temperature R 16-bit signed integer		[0.1°C]
818	Digital Input	Shows the digital inputs status R 16-bit signed integer		
820	Digital output	Shows the digital outputs status R 16-bit signed integer		
822	Brake output	Shows the electromagnetic brake status R 16-bit signed integer		
825	Register Overload %	Describe the voltage overload percentage referred to the motor R 16-bit signed integer		0 ÷ 100%
832	Supply time 16LSB	Supply time (seconds) – 16LSB R 16-bit signed integer		Value is latched on reading 16LSB
833	Supply time 16MSB	Supply time (seconds) – 16MSB R 16-bit signed integer		Value is latched on reading 16MSB
834	Inverter on 16LSB	Inverter on (seconds) – 16LSB R 16-bit signed integer		Value is latched on reading 16LSB
835	Inverter on 16MSB	Inverter on (seconds) – 16MSB R 16-bit signed integer		Value is latched on reading 16MSB
837	SW version micro	Indicates the software version stored in the drive R 16-bit signed integer		
838	SW version encoder	Indicates the software version stored in the encoder R 16-bit signed integer		
4132	Reference generator state	0	OFF	No enable
		1	ENABLED	Enabled without run
		2	HALTED	PWM on with zero speed control
		3	ACCEL	PWM on with acceleration control

		4	DECEL	PWM on with deceleration control
		5	STEADY	PWM on with non-zero speed control
		6	STOPPING	PWM with deceleration until zero speed
		Indicates the drive status.		

7.3 Homing register

ID	NOME	DESCRIZIONE	NOTE
257	Homing type	Defines the homing type according to the CanOpen CIA402 standard. Equivalent to P152 parameter RW 16-bit signed integer	Homing available: 1 ÷ 15 33 ÷ 35
258 - 259	Home Offset	Defines the offset value taken into account during the homing. Equivalent to P168 – 169 parameters RW 32-bit unsigned integer	[User unit]
260	Homing switch search speed	Defines the motor speed during the research of the limit switch Equivalent to P153 parameter RW 16-bit unsigned integer	[rpm]
261	Homing index search speed	Defines the motor speed during the achievement of the index pulse Equivalent to P154 parameter RW 16-bit unsigned integer	[rpm]
262	Homing acceleration	Defines the motor acceleration used to reach the home settled velocity starting from zero velocity Equivalent to P155 parameter RW 16-bit unsigned integer	[rpm/s]
263	Homing deceleration	Defines the motor acceleration used to reach the zero velocity starting from the target velocity Equivalent to P156 parameter RW 16-bit unsigned integer	[rpm/s]

264	Homing max time out	Defines the time limit to the data exchange during the homing procedure. If this limit is exceeded an error signal is generated Equivalent to P157 parameter RW 16-bit unsigned integer	[s]	
265	Homing max current	Defines the current limit during the homing procedure. If this limit is exceeded an error signal is generated Equivalent to P158 parameter RW 16-bit unsigned integer	[mA]	
266	Homing Cmd	This parameter enables or disables the homing procedure RW 16-bit unsigned integer	0	None
			1	Enable

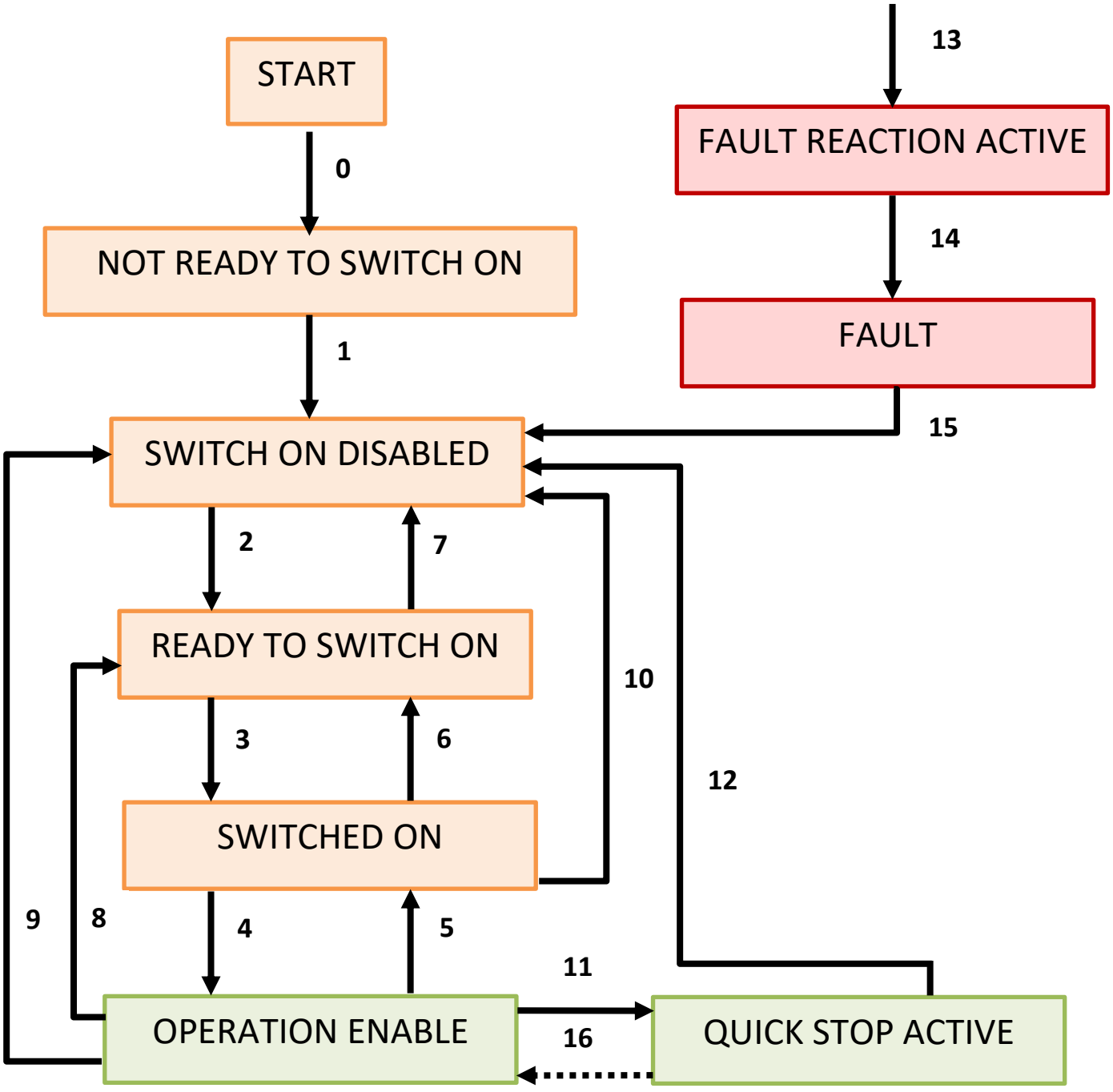
8 CiA402 – Servodrive application profile

8.1.1 Supported modes

The following mode of operations are supported by the servodrive implementation

	Mode of operation encoding
PROFILE POSITION MODE	**1**
PROFILE VELOCITY MODE	**3**
PROFILE TORQUE MODE	**4**
HOMING MODE	**6**
INTERP. POSITION MODE (Optional)	**7**
CYCLIC SYNCHRONOUS POS. (Optional)	**8**

8.1.2 State machine



States in yellow have power disabled. States in green have power enebled. Red states are alarm states.

State machine description

State	Descriptions
Not Ready to Switch On	Axis not ready to start, initialization not completed.
Switch On Disable	Axis ready to be started, parameters can be transferred, power can be enabled.
Ready To Switch On	Parameters can be transferred, power can be enabled, motor cannot be actuated
Switched On	Parameters can be transferred, power can be enabled, motor cannot be actuated

Operation Enable	No fault Present, Motor functions and power are enabled.
Quick Stop Active	Drive stopped with an emergency ramp, power enabled, functions disabled.
Fault Reaction Active	An Error occurred, drive is stopping.
Fault	A fault is active, drive is stopped and disabled.

To change between states, following the numbered transitions, you need to send the correct control word, object 6040h, with specific bits enabled as shown in the following table.

Command	6040h Control Word bits					Transitions
	Bit 7	Bit 3	Bit 2	Bit 1	Bit 0	
Shutdown	0	X	1	1	0	2,6,8
Switch On	0	0	1	1	1	3
Disable Voltage	0	X	X	0	X	7,9,10,12
Quick Stop	0	X	0	1	X	7,10,11
Disable Operation	0	0	1	1	1	5
Enable Operation	0	1	1	1	1	4,16
Fault Reset		X	X	X	X	15

Control Word encoding i sas following:

Bit	Sigla	Nome	Specific Functionality
0	so	Switch On	
1	ev	Enable Voltage	
2	qs	Quick Stop	
3	eo	Enable Operation	
4	oms	Operating Mode Specific	New Setpoint - Homing Start - Enable Interpolaiton
5	oms	Operating Mode Specific	Change Setpoint Immediatly
6	oms	Operating Mode Specific	Absolute/Relative
7	fr	Fault Reset	
8	h	Halt	
9	oms	Operating Mode Specific	Change on Setpoint
10	r	Reserved	
11	ms	Manufacturer Specific	Touch Probe Offset Mode
12	ms	Manufacturer Specific	Touch Probe Module mode
13	ms	Manufacturer Specific	
14	ms	Manufacturer Specific	
15	ms	Manufacturer Specific	

The drive state is communicated with object 6041h, the Status Sword.

The DS402 State Machine States are communicated with the following bits from the Status Word

StatusWord bit values	State Machine State
xxxx xxxx x0xx 0000	Not Ready To Switch On
xxxx xxxx x1xx 0000	Switch On Disabled
xxxx xxxx x01x 0001	Ready To Switch On
xxxx xxxx x01x 0011	Switched On
xxxx xxxx x01x 0111	Operation Enabled
xxxx xxxx x00x 0111	Quick Stop Active
xxxx xxxx x0xx 1111	Fault reaction Active
xxxx xxxx x0xx 1000	Fault

Status Word encoding is the following:

Bit	Sigla	Nome
0	rtso	Ready to Switch On
1	so	Switched On
2	oe	Operation Enabled
3	f	Fault
4	ve	Voltage Enabled
5	qs	Quick Stop
6	sod	Switch On Disabled
7	w	Warning
8	ms	Manufacturer Specific
9	rm	Remote
10	tr	Target Reached
11	ila	Internal Limit Active
12	oms	Operating Mode Specific
13	oms	Operating Mode Specific
14	ms	Manufacturer Specific
15	ms	Manufacturer Specific

The Operating Mode Specific bits of the Status Word have the following meaning depending on the Operating Mode.

6040h	Profile Position	Profile velocity	Profile Torque	Homing	Interpolation	CSP
Bit 10	Target Reached			Homing Done	Target reached	Toggle
Bit 12	Set point ack	Zero Speed	//	//	Interp active	Following setpoint
Bit 13	Following Error	//	//	Homing Error	//	Folllowng Error

8.1.3 Position/speed/torque scaling

Position scaling is managed using a manufacturer specific mechanism. By changing servodrive parameters is possible to set the relation from position pulses and “position units” by means of:

- PosFactorNum (NUM)
- PosFactorDen (DEN)
- PosFactorDecimal (DEC)
- UserPosInversion (INV)

$P_{Pulses}=P_{PosUnits} * NUM/DEN * 10^{DEC} * INV$

$P_{PosUnits}=P_{Pulses} * DEN/NUM * 10^{-DEC} * INV$

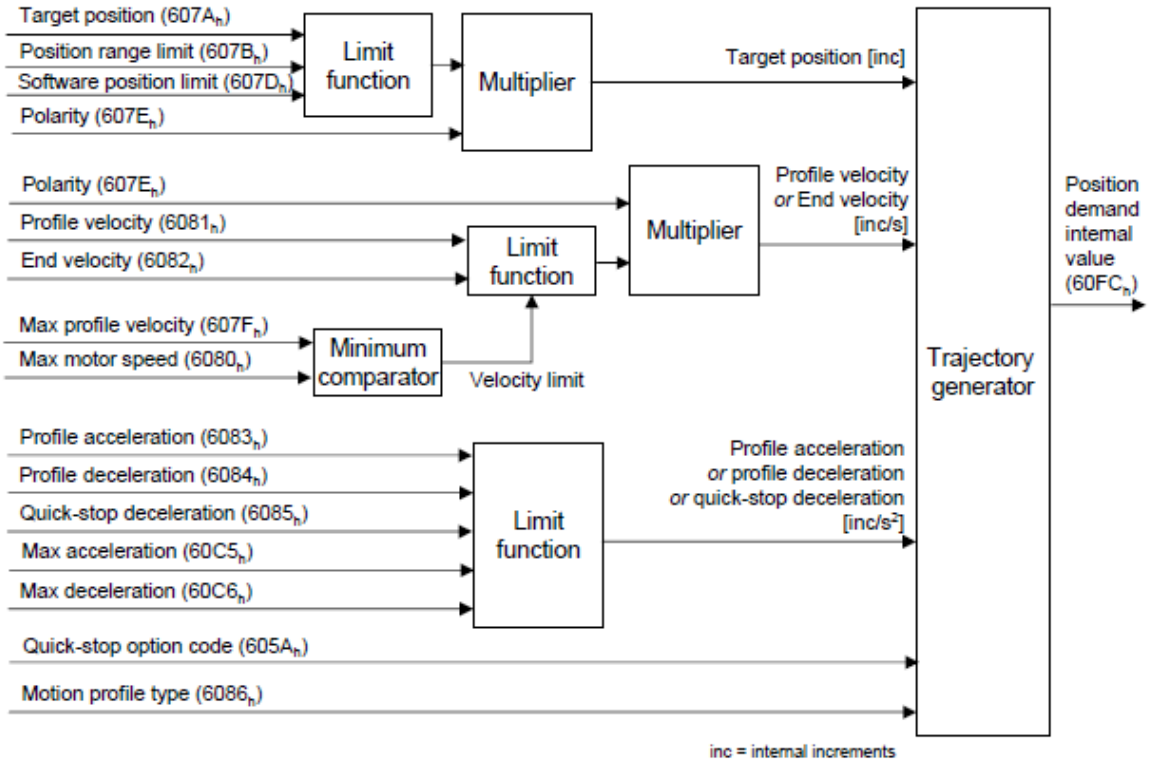
Furthermore, is possible to set the polarity of the position and the speed information; the position scaling is not accessible via CanOPEN but the position scaling defined via parameter is applied to all position objects that are specified as “Position units”.

The only exception is the polarity object (607Eh) that allows from the bus to change the direction of the position and/or velocity as defined by CiA402:

- Position Polarity Flag affects Profile position
- Velocity Polarity Flag affects Profile velocity

Homing mode and Torque mode are not affected by polarity.
Velocity units are RPM (round per minute) and acceleration units are RPM/S (round per minute over a second).

8.1.4 Profile position



The profile position implementation includes the following features:

- Standard (Set of set-point) mode: up to 5 position targets can be stored using NEW_SET/SET_ACK mechanism
- Change Setpoint Immediately mode: after NEW_SET/SET_ACK the target is applied immediately
- Relative/Absolute
- Position limits (607Dh)
- Online limit change for Profile Velocity/Acceleration/Deceleration

Optional features NOT IMPLEMENTED:

- Change on setpoint mode: this mode is ignored and set of setpoint will be user
- Halt option code (605Dh): halt will always happen using profile deceleration
- Position range objects (607B): positioning will always happen inside the range given by Position limit objects, position wrap is not possible
- End velocity is always zero rpm (6082h)
- Motion profile type (6086h) is not supported, profile is always speed-trapezoidal.
- Positioning option code (60F2h):
    - Relative positioning is always referred to previous target
    - Change setpoint immediately will always take place immediately
    - Newset/setack will always take place as specified in section 10.2 of CiA402
    - Position wrap of the range is not supported and will saturate to position limits

Manufactor specific function implemented:

- using manufactor specific bits in the control word (Bit11...15) is possible to enable manufactor specific functions
- implemented function are triggered by values in the next table

Function	Bit15	Bit14	Bit13	Bit12	Bit11
Standard behaviour	0	0	0	0	0
Touchprobe positioning (DIN1 rising edge)	0	0	0	0	1
Touchprobe positioning (DIN1 falling edge)	0	0	0	1	0
Touchprobe modulo positioning (DIN1 rising edge)	0	0	0	1	1
Touchprobe modulo positioning (DIN1 falling edge)	0	0	1	0	0
Wait for global time	0	1	0	0	0
Wait for sync	0	1	0	0	1

Other configuration of Bit11..Bit15 are reserved.

- During Touch-probe positioning the status_word is extended using manufactor specific Bit14/Bit15 with the following meaning:

Function	Bit15	Bit14
Standard behaviour	0	0

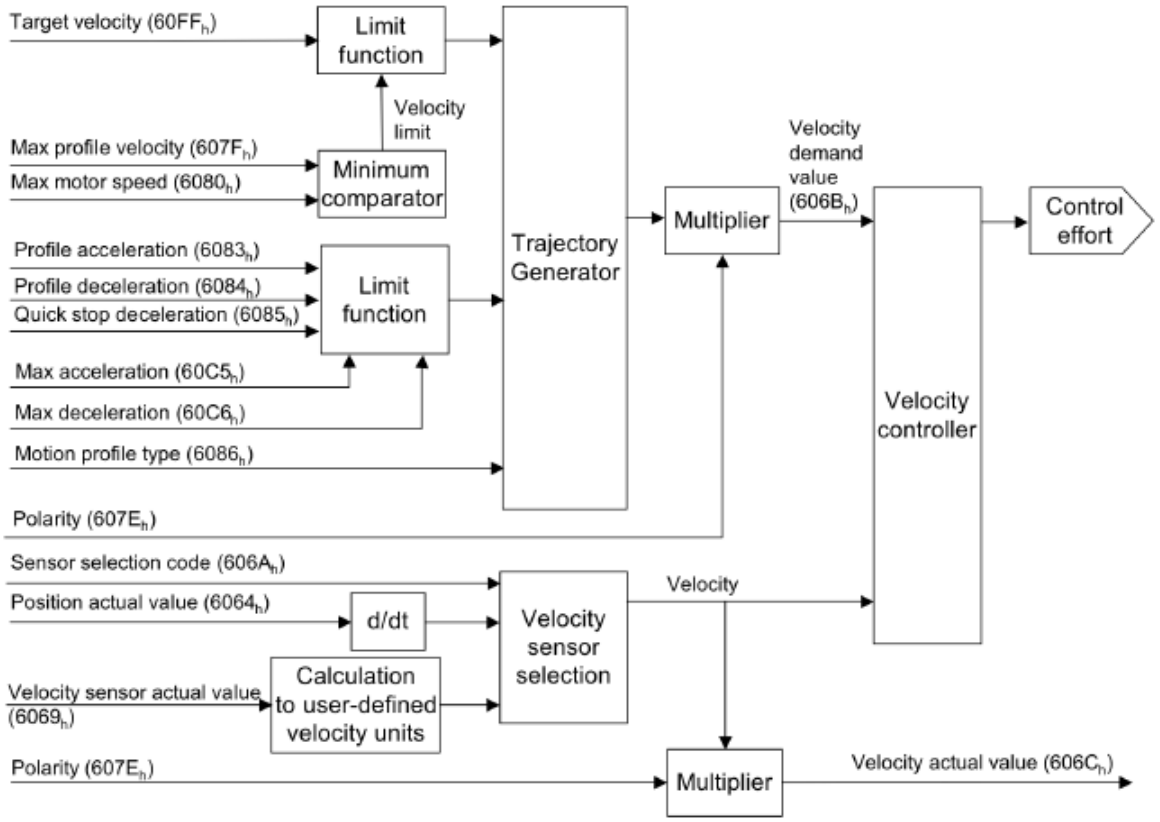
Touchprobe positioning armed (wait for touch_probe)	0	1
Touchprobe positioning position sensed, wait to complete	1	1
not allowed	*1*	*0*

See section DBS touch-probe extensions.

The “wait for global time” and “wait for sync” modes allow to defer the start of the profile generation on a particular event:

- Wait for global time: in fieldbus where the global time exists (e.g. Ethercat, CanopenOverAir) using object 3018h (profile position sync time) is possible to defer the profile generation until the sync time reaches a given value
- Wait for sync: in CanOpen over can-bus, is possible to defer the start of the profile until the drive detects a SYNC message on the bus

8.1.5 Profile velocity

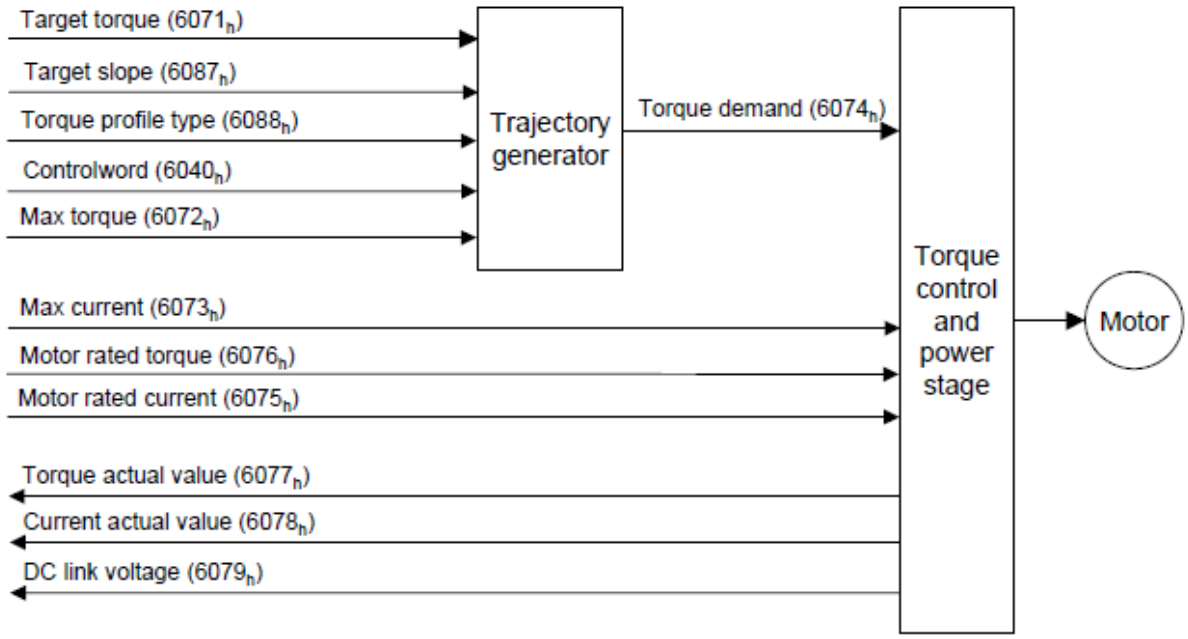


Optional feature NOT IMPLEMENTED:

- Sensor code (6069h); the velocity is derived from the position information

- Sensor selector code (606Ah); position sensor cannot be selected
- Max slippage (60F8h) is not implemented since the max slippage control does not make sense for servodrive
- Motion profile type (6086h) is not supported, profile is always speed-trapezoidal.

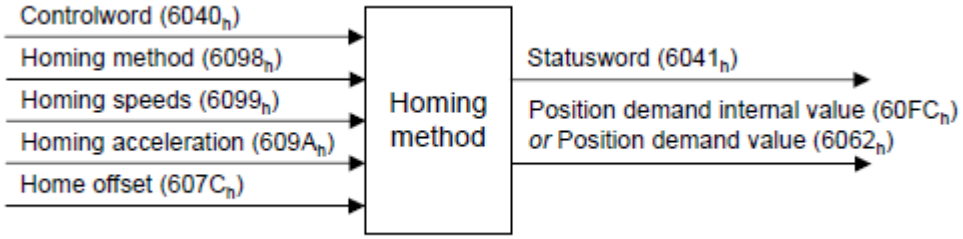
8.1.6 Profile torque



Optional feature NOT IMPLEMENTED:

- Torque profile type (6088h) is not supported, profile is always torque-trapezoidal

8.1.7 Homing



Implemented homing types:

- Negative/positive switches (1, 2)
- Home + index (3,4,5,6)
- Home on the right + index (7,8,9,10)
- Home on the left + index (11,12,13,14)
- Index (33, 34)
- Set quota (37)

Homings are described in paragraph 11.

Optional feature NOT IMPLEMENTED:

- Supported homing methods object (60E3h): the supported homing methods are described in the previous section and in the servodrive manual.

8.1.8 Touch probe (optional)

This functionality is implemented and uses DIN1. Touchprobe allows precise capture of the position while motor is running.

Touch-probe function 60B8h

Bit	Value	Definition
0	0	Switch off touch probe 1
	1	Enable touch probe 1
1	0	Trigger first event
	1	continous
4	0	Switch off sampling at positive edge of touch probe 1
	1	Enable sampling at positive edge of touch probe 1
5	0	Switch off sampling at negative edge of touch probe 1
	1	Enable sampling at negative edge of touch probe 1

bit 2..3 and 6..15 are reserved and should be left to zero.

Touch-probe status 60B9h

Bit	Value	Definition
0	0	Touch probe 1 is switched off
	1	Touch probe 1 is enabled
1	0	Touch probe 1 no positive edge value stored
	1	Touch probe 1 negative edge position stored
2	0	Touch probe 1 no negative edge value stored
	1	Touch probe 1 positive edge position stored

bit 3..15 are not used and will be read as zero.

Operation:

1. Touch-probe is armed via Bit0 of Function; capture can happen on first event or continuously (Bit1 of Function) and on rising or falling edge of the DIN1 input. At least one of Bit4 or Bit5 must be set in order to arm touch-probe sensing
2. Function is detected as armed via Status object Bit0
3. Whenever the first capture happens (either on rising edge or falling edge or both) Bit1 and Bit2 of Status will provide feedback to master. Objects 60BAh and 60BBh will allow master to read the probed motor position
4. If continuous operation is selected, subsequent events will update position read by master but Bit1/Bit2 of Status will retain set state

8.1.9 Interpolated mode (optional)

This profile allows operation with a numerical control; target buffering on the device side is NOT implemented: one value needs to be sent by the master to the device for each sync period and the device will generate a ramp that will drive the motor to that position on the end of the NEXT sync period; the next figure illustrate how the data exchange works.

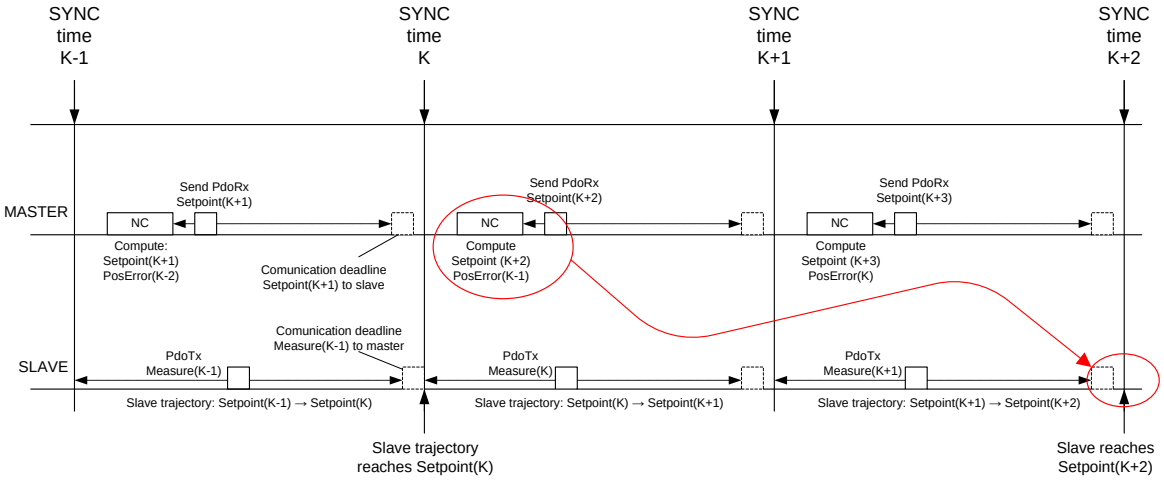


Figure 21

Is worth noting that interpolated position mode inserts a delay of two sync periods from the master point of view: for example at time K, the numeric control will compute the position error of the previous sync period (K-1) and will compute the target that the slave will reach at time (K+2).

Implemented features details:

- interpolation submode selection (60C0h, type 0), only default linear interpolation can be selected
- allowed interpolation period range is 1.0ms ... 100.0ms

Optional features aren't implemented:

- position range objects not implemented (607Bh)
- interpolation data configuration (60C4h) is not implemented since there is NO interpolation data buffer on the device; one target must be transferred from master on each synchronization period
- profile parameters don't influence trajectory generation; the master is responsible of limiting speed/acceleration/deceleration in this mode

8.1.10 Cyclic synchronous position mode (optional) – Only on EtherCAT/Powerlink

The cyclic synchronous position mode allows interpolation in a similar way of the interpolated mode; this mode allows the master to manage more precisely the reference generation inside the servodrive. The following scheme is employed:

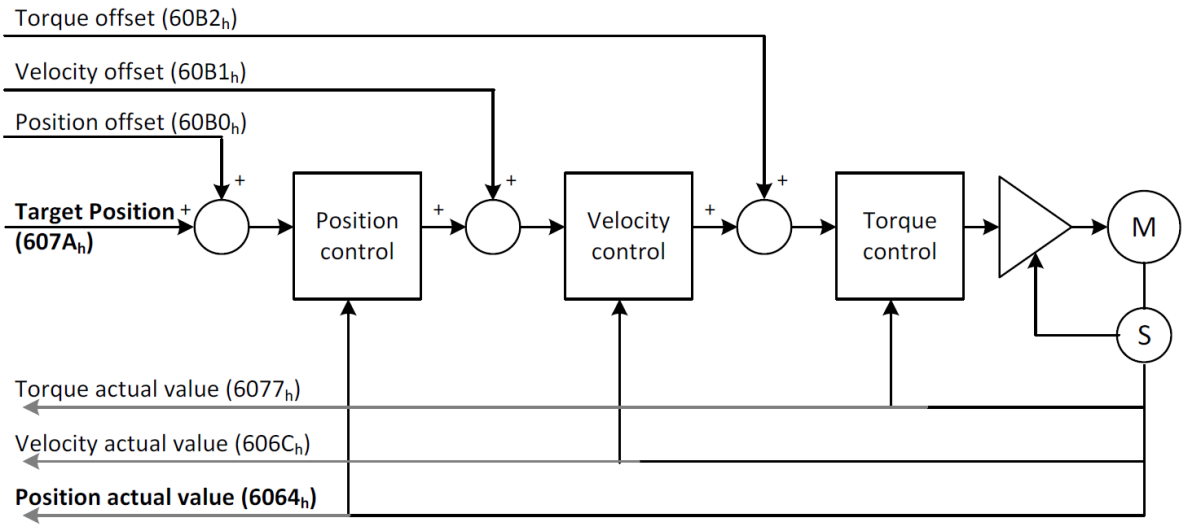


Figure 22

Using the offset objects, master can give feedforward actions in the inner loops of the servodrive allowing, for example, load torque compensation.

The following optional functionalities are not supported in the CSP implementation:

- Output Cycle Counter (bit5/6 of control word) is not supported; objects 60D9h, 60DAh are not implemented
- Bit13 of the status word is the following error and not the second bit of Input Cycle Counter.

8.1.11 Cyclic synchronous velocity mode

This functionality is not implemented.

8.1.12 Cyclic synchronous torque mode

This functionality is not implemented.

8.2 Default PDO mapping

PDORX1	**COB-ID: 0200h + NODEID – Enabled by default Mapping:** • **6040h: control word** • **607Ah: target position** • **3012h: Max current mA**
PDORX2	COB-ID: 0300h + NODEID – Enabled by default Mapping: • 60FFh: target velocity • 6071h: target torque • 6060h: mode of operation
PDORX3	COB-ID: 0400h + NODEID – Disabled by default
PDORX4	COB-ID: 0500h + NODEID – Disabled by default
PDOTX1	COB-ID: 0180h + NODEID – Enabled by default Mapping: • 6041h: status word • 6064h: position actual value • 3011h: current value mA Trasm type: 255 + event time 100ms
PDOTX2	COB-ID: 0280h + NODEID – Enabled by default Mapping: • 606Ch: velocity actual value

	• 3010h: tension value • 6061h: mode of operation display Trasm type: 255 + event time 100ms
PDOTX3	COB-ID: 0380h + NODEID – Disabled by default
PDOTX4	COB-ID: 0480h + NODEID – Disabled by default

8.3 EMCY codes

The following table summarizes the emergency codes emitted by the servodrive whenever an alarm is detected.

Code	Meaning
2220h	Continuous overcurrent
2230h	Instantaneous overcurrent
3110h	Overvoltage in power supply
4210h	Overtemperature in the power stage
4310h	Overtemperature in the motor
5530h	Hardware data storage error
5531h	Software data storage error
5532h	Parameter value error
6200h	User generated alarm
9000h	Digital input generated alarm
FF04h	Motor parameters copy error
FF05h	Motor parameter copy error (speed loop)
FF15h	1ms task overtime
FF16h	10ms task overtime
FF19h	Parameter restore error
FF20h	Motor not calibrated
FF21h	No movement during encoder calibration procedure
FF22h	Wrong direction during encoder calibration procedure
FF23h	Error during autoconfiguration procedure
FF24h	Error reading encoder multiturn information
FF25h	Error reading encoder singleturn information

8.4 DBS touch-probe extensions (optional)

The DBS family provide some extension to the standard touch probe mechanism.

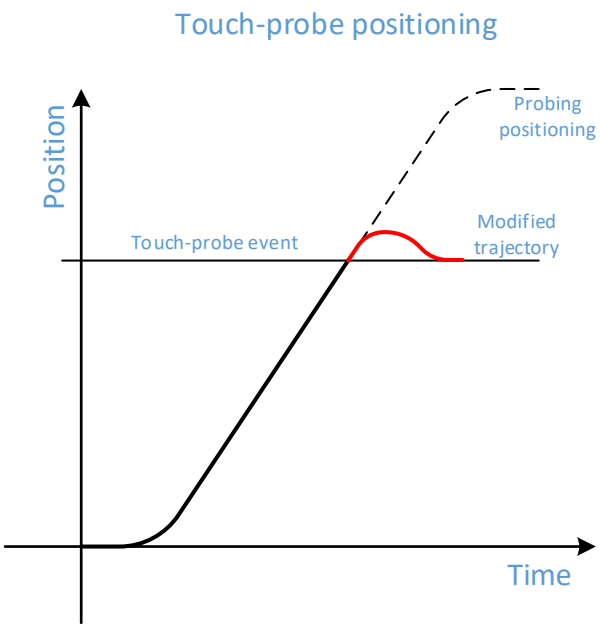
8.4.1 Touch-probe positioning

This function allows to modify on the fly the trajectory of the on-going positioning in order to reach the position related to the touch-probe event. This function is available when profile position is active.

The touch-probe positioning allows the following operation:

- motor is standstill
- master start a movement via standard “new_set” bit (control_word=001Fh)
- motor starts with defined profile position kinematic constraints (speed/acceleration)
- Master enables touch-probe positioning via Bit11..15 of the control word; for example touch-probe positioning on the rising edge of DIN1 is triggered by updating control_word=081Fh; status word Bit14 is set by motor reflecting positioning “armed”
- when the touch-probe is sensed the related position is captured (TP_Pos) and the status word Bit15 is set by motor signaling “position captured”
- motor modifies the trajectory in order to reach the target TP_Pos+TP_Offset (object 3020h)
- Motor reaches the position and stops (status word is updated as usual with Bit10 target reached).

The following diagram shows the behavior of the motor in “touch-probe positioning”:



8.4.2 Touch-probe modulo positioning

This function is similar to the previous but allows to manage positioning by means of “modulo” position. This allows for example to deal with circular axis where the same point can be reached in a given position P1, in the next modulo P1+MOD, after two modulo P1+2*MOD etc.

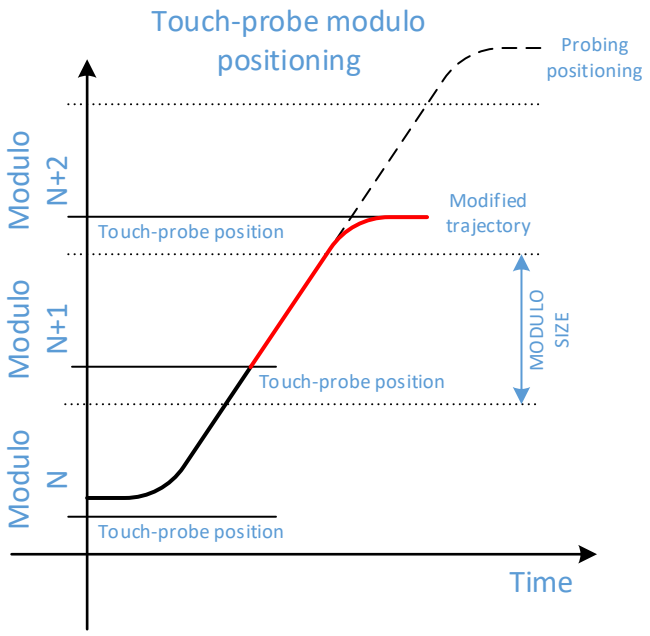
The typical example is where the modulo MOD is 1 motor turn; in the DBS the resolution of one turn is 4096 pulses/rev so in this example a given application point can be reached when the motor position is 0, 4096, 8192 etc; default value for object TP_Modulo 3021h is 4096.

The purpose of the Touch-probe modulo positioning is reach the probed position without inverting the motion direction as soon as possible.

A typical operation is described by these steps:

- motor is standstill
- master start a movement via standard “new_set” bit (control_word=001Fh)
- motor starts with defined profile position kinematic constraints (speed/acceleration)
- master enables touch-probe positioning via Bit11..15 of the control word; for example touch-probe modulo positioning on the rising edge of DIN1 is triggered by updating control_word=181Fh; status word Bit14 is set by motor reflecting positioning “armed”
- when the touch-probe is sensed the related position is captured (TP_Pos) and the status word Bit15 is set by motor signaling “position captured”
- motor modifies the trajectory in order to reach the target TP_Pos+TP_Modulo (object 3021h) without changing direction
- motor reaches the position and stops (status word is updated as usual with Bit10 target reached).

The following diagram shows the behavior of the touch-probe modulo positioning:



Is worth noting that depending on kinematic constraints (profile velocity, acceleration, deceleration), the position that can be reached without inverting the direction could be farther than the position in the next modulo.

This example clarifies the scenario:

- modulo size: 4096
- start position: 2048
- probe position: 0 (and 4096, 8192,12288 etc.)
- the probing positioning in started in positive direction with high acceleration/speed and with low deceleration
- then motor reaches the first time the probe (position=4096);
- with given deceleration, the halt space is greater than 4096 pulses (e.g. 6000pulses); the motor modifies the target position to 12288 (2 turns after the probe)
- the motor reaches 12288 and stops.

In order to deal with this problem, when the touch probe event trigger the destination change, the DBS computes the halting space and modifies the destination in order to prevent direction change.

9 CanOpen / EtherCAT / PowerLink

Note: available only for drivers equipped with CanOpen/Modbus RTU, CanOpen over EtherCAT or Ethernet PowerLink. (DBS55/---/C; DBS55/---/ETH; DBS55/---/EPL).

9.1 Overview

The present document describes the adherence of the Minimotor stack to the following specification:

CanOPEN

- CiA DS301 v4.02 (CanOPEN DLL)
- CiA DS402 v3.0.1.15 (servodrive profile)

CanOPEN over EtherCAT:

- ETG1000-2 v1.0.1 (physical layer)
- ETG1000-3 v1.0.1 (DLL services)
- ETG1000-4 v1.0.1 (DLL protocols)
- ETG1000-5 v1.0.1 (AL services)
- ETG1000-6 v1.0.1 (AL protocols)
- CiA DS402 v3.0.1.15 (servodrive)
- ETG6010 v1.1.0 (CiA 402 impl. directives)

Ethernet PowerLink (EPL)

- EPSG DS 301 V1.2.0 (Powerlink DLL)

The purpose of the present document is to describe what optional feature are implemented by the servo-motor CanOPEN, CoE or EPL.

****** Applicable DBS55/---/--- software release:* ≥v4.036 *******

9.2 DS301 Communication layer

This paragraph describe the details of the DS301 layer of the CanOpen interface.
It applies only to the CanOPEN over can-bus implementation.

9.2.1 Physical layer

Supported baudrate:

- 1Mbps tq=71ns SamplingPoint=11tq
- 500Kbps tq=142ns SamplingPoint=12tq
- 250Kbps tq=284ns SamplingPoint=12tq
- 125Kbps tq=571ns SamplingPoint=12tq
- 50Kbps tq=1.43us SamplingPoint=12tq
- 20Kbps tq=3.57us SamplingPoint=12tq

9.2.2 SDO protocol

- Maximum supported object size: 32bit
- Eexpedited transfer supported SUPPORTED
- Segmented transfer: NOT SUPPORTED
- Block transfer: NOT SUPPORTED

9.2.3 TIME protocol

The time protocol is NOT supported.

9.2.4 PDO protocol

The implementation supports up to 4 Pdo TX and 4 Pdo RX; each object can map up to 8 objects; mapping can be done only using the whole size of the object (i.e. is not possible to map 8 bit of a 32 bit object).

The following transmit type are implemented for PDO TX:

Trasmission type	
0	PDO is emitted when changes after SYNC is received
1..240	PDO emitted after SYNC, depending on SYNC message occurrence (1 every sync, 2 every 2 sync etc.).
241..251	NOT supported
252..253	PDO is emitted after RTR reception: • 252: data sampled on SYNC, emitted after RTR • 253: data sampled and emitted after RTR
254	NOT supported
255	PDO is emitted asynchronously; two feature are supported for emission control: • inhibit time for emission only when PDO content changes • event timer for periodical (asynchronous) emission

Defaults:

- inhibit time: 100ms
- event time: 0 (periodic emission on TT=255 disabled by default)

See application profile for default PDO configuration. (See paragraph 8.2)

9.2.5 EMCY protocol

Emergency protocol is implemented for reporting alarms from the servodrive; to control the emission of EMCY messages, the inhibit time (object 1015h) can be modified.
See the application profile for detailed list of alarms. (See paragraph 8.3)

9.2.6 NMT protocol

The NMT implementation includes standard commands for NMT state machine management.
For node alive checking, the NODE GUARDING protocol is implemented; the behaviour of node guarding is set by objects 100Ch (guard time) and 100Dh (life factor).

9.2.7 HEARTBEATING

Heartbeating Protocol is supported. Register 1016h defines the time in multiples of 1ms for the Heartbeat protocol consumer. Register 1017h determines the time in multiples of 1ms for the producer of the protocol. Object 1029h determines the behaviour when the error is triggered.

9.3 Object dictionary

Object dictionary is divided in the following sections:

Range oggetti	Funzioni
1000h ... 1FFFh	Communication profile area
2000h ... 21FFh	Manufactor parameter area
3000h ... 3FFFh	Manufactor specific object area
6000h ... 67FFh	Profiled objects

Other areas are unused; the object list is common between CanOPEN, CoE and EPL implementation.

9.3.1 Communication area

The following table shows the list of communication area objects; since some object are relevan only for CanOPEN or CoE implementation, the table shows in which fieldbus the object is relevant.

Index	Description	CanOPEN	CoE	EPL
1000	Device type	X	X	X
1001	Error register	X	X	X
1003	Predefined error	X	X	
1006	Cycle length			X
100C	Guard time	X		
100D	Life factor	X		
1010	Store parameters (*1)	X	X	X
1014	EMCY cob-id	X		
1015	EMCY inhibit time	X	X	
1016	Consumer Heartbeat Time	X		
1017	Producer Heartbeat Time	X		
1018	Identity object	X	X	X
1020	CFM Verify Configuration			X
1029	Error Behaviour	X		
1030	NMT Interface Group 0h			X
1300	SDO Sequ Layer Timeout			X
1400	PDO RX 1 – config (*2)	X	X	X
1401	PDO RX 2 – config	X		
1402	PDO RX 3 – config	X		
1403	PDO RX 4 – config	X		
1600	PDO RX 1 – mapping (*2)	X	X	X
1601	PDO RX 2 – mapping	X		
1602	PDO RX 3 – mapping	X		
1603	PDO RX 4 – mapping	X		
1800	PDO TX 1 – config (*2)	X	X	X
1801	PDO TX 2 – config	X		
1802	PDO TX 3 – config	X		
1803	PDO TX 4 – config	X		
1A00	PDO TX 1 – mapping (*2)	X	X	X
1A01	PDO TX 2 – mapping	X		

1A02	PDO TX 3 – mapping	X		
1A03	PDO TX 4 – mapping	X		
1C00	Sync manager types		X	
1C0A	DLL_CnCollision REC			X
1C0B	DLL_CnLoss REC			X
1C0C	DLL_CnLossSoC_REC			X
1C0D	DLL_CnLossSoA REC			X
1C0E	DLL_CnSpCJitter REC			X
1C0F	DLL_CnCRCError REC			X
1C10	Sync manager 0 config		X	
1C11	Sync manager 1 config		X	
1C12	Sync manager 2 config		X	
1C13	Sync manager 3 config (*2)		X	
	DLL_CnSocJitterRange (*2)			X
1C14	DLL_CnLossOfSocTolerance			X
1C32	Output sync parameters		X	
1C33	Input sync parameters		X	
1E40	NWL_IpAddrTable_0h_REC			X
1E4A	NWL_IpGroup_REC			X
1F82	NMT_FeatureFlags_U32			X
1F83	NMT_EPLVersion_U8			X
1F8C	NMT_CurrNMTState_U8			X
1F93	NMT_EPLNodeID_REC			X
1F98	NMT_CycleTiming_REC			X
1F99	NMT_CNBasicEthernetTimeout_U32			X
1F9A	NMT_HostName_VSTR			X
1F9E	NMT_ResetCmd_U8			X

(*1) To save 2000h parameters to non-volatile storage a 32bit write to object 1010h.1 needs to be performed; in particular the value to be written to save parameter is 65766173h (“SAVE”).

(*2) PDO config and mapping have different encoding for CoE/CanOPEN and EPL. Please check DLL manual for details.

9.3.2 Manufacturer parameter area

The object range 2000h ... 21FFh allows to access servodrive parameters; the following table summarize the details of a parameter object:

Object details

Subidx	0
Object type	16bit, signed integer
Access	Read/Write
Pdo mappable	NO

Object dictionary for manufacturer parameters

Index	
2000	Parameter 0
2001	Parameter 1
...	

21FF	Parameter 511

For details of the parameter meaning and encoding refer to the servodrive manual.
NOTE: write objects in the 2000h ... 21FFh range will alter only RAM image of the parameter; to actually save parameter to non-volatile storage a write to object 1010h.0 needs to be performend (see 1010h).

9.3.3 Manufacturer specific area

This area contains several object that allows to read/write manufacturer specific data.

Index		Access	Data type	Pdo mappable
3000	Ain0 value -32768 ... 32768	RO	INT16	YES
3001	Digital input bit0: digital input0 bit1: digital input1 bit2: digital input2 bit3: digital input3 bit4: digital input4	RO	UINT16	YES
3002	Digital output bit0: digital output0	RW	UINT16	YES
3003	Heatsink temperature as tenth of °C (200 >> 20.0°C)	RO	INT16	YES
3005	Motor temperature as tenth of °C (200 >> 20.0°C)	RO	INT16	YES
3008	Actual alarm: 0: no alarm >0: an alarm is pending NOTE: value read from this object is the alarm code as defined in the DBS manual (e.g. OVERVOLTAGE=3 etc) **Value IS NOT the EMCY code as defined in this document.**	RO	UINT16	YES
3009	Events 0: 16 1-16: event code (see 6.1)	RO	UINT	NO
3010	Power stage tension as tenth of Volt (240 >> 24.0V)	RO	UINT16	YES
3011	Motor IQ current as milliAmpere (+10 >> +1.0A)	RO	INT16	YES
3012	Motor IQ limit as milliampere (10 >> 1.0A)	RW	UINT16	YES
3014	Output Power (1Watt/lsb)	RO	IN16	YES
3020	Touchprobe Positioning offset	RW	INT32	YES
3021	Touchprobe Positioning Modulo	RW	UINT32	YES
3030	Acceleration rms modulus (milli-G)	RO	UINT16	YES

3031	Acceleration rms x (milli-G)	RO	UINT16	YES
3032	Acceleration rms y (milli-G)	RO	UINT16	YES
3033	Acceleration rms z (milli-G)	RO	UINT16	YES
3034	Acceleration dc x (milli-G)	RO	UINT16	YES
3035	Acceleration dc y (milli-G)	RO	UINT16	YES
3036	Acceleration dc z (milli-G)	RO	UINT16	YES
3037	Istantaneous Acceleration x (milli-G)	RO	INT16	YES
3038	Istantaneous Acceleration y (milli-G)	RO	INt16	YES
3039	Istantaneous Acceleration z (milli-G)	RO	INT16	YES

9.3.4 Profiled objects

The range 6000h ... 67FFh of objects are defined as specified by CiA402; refer to the application area for further information.

Index		Access	Type	Pdo mappable
6040	Control word	RW	U16	YES
6041	StatusWord	RO	U16	YES
605A	Quickstop option code	RW	U16	
605B	Shutdown option code	RW	U16	
605C	Disable operation option code	RW	U16	
605D	Halt option code	RW	U16	
605E	Fault reaction option code	RW	U16	
6060	Mode of operation	RW	S8	YES
6061	Mode of operation display	RO	S8	YES
6062	Position demand value	RO	S32	YES
6064	Position actual value	RO	S32	YES
6065	Following error window	RW	U32	
6066	Following error time	RW	U16	
6067	Position window	RW	U32	
6068	Position window time	RW	U16	
606B	Velocity demand	RO	S32	YES
606C	Velocity actual value	RO	S32	YES
606D	Velocity window	RW	U16	
606E	Velocity window time	RW	U16	
606F	Velocity threshold	RW	U16	
6070	Velocity threshold time	RW	U16	
6071	Target torque	RW	S16	YES
6072	Max torque	RW	U16	YES
6073	Max current	RW	U16	YES
6074	Torque demand value	RO	S16	YES
6075	Motor rated current	RO	U32	YES

6076	Motor rated torque	RO	U32	YES
6077	Torque actual value	RO	S16	YES
6078	Current actual value	RO	S16	YES
6079	Dclink voltage	RO	U32	YES
607A	Target position	RW	S32	YES
607C	Home offset	RW	S32	YES
607D	Software position limit 607D.0: number of sub-idx (2) 607D.1: Negative limit 607D.2: Positive limit	 RO RW RW	 U8 S32 S32	 YES YES
607E	Polarity	RW	U8	
607F	Max speed	RO	U32	YES
6080	Max speed	RO	U32	YES
6081	Profile velocity	RW	U32	YES
6083	Profile acceleration	RW	U32	YES
6084	Profile deceleration	RW	U32	YES
6085	Quick stop deceleration	RW	U32	YES
6087	Torque slope	RW	U32	YES
6098	Homing method	RW	S8	YES
6099	Homing speed 6099.0 – number of subidx (2) 6099.1 – Switch speed 6099.2 – Index speed	 RO RW RW	 U8 U32 U32	 YES YES
609A	Homing acceleration	RW	U32	YES
60B0	Position offset	RW	S32	YES
60B1	Velocity offset	RW	S32	YES
60B2	Torque offset	RW	S16	YES
60B8	Touch-probe function	RW	U16	YES
60B9	Touch-probe status	RW	U16	YES
60BA	Touch-probe positive edge latched position	RW	S32	YES
60BB	Touch-probe negative edge latched position	RW	S32	YES
60C0	IpData submode selection	RO	S16	NO
60C1	IpDataRecord 60C1.0 – Number of sub-idx (1) 60C1.1 – IpData record	 RO RW	 U8 S32	 YES
60C2	Interpolation time period 60C2.0 – number of sub-idx 60C2.1 – Ip time units 60C2.2 – Ip time index	 RO RW RW	 U8 S8 S8	
60FD	Digital inputs	RO	U32	YES
60FE	Digital outputs 60FE.0 – number of sub-idx (2) 60FE.1 – physical outputs 60FE.2 – output mask	 RO RW RW	 U8 U32 U32	 YES YES
60FF	Target velocity	RW	S32	YES
6502	Supported mode of operation	RO	U32	NO

10 Ethernet IP

Note: available only for drivers equipped with Ethernet IP optional board (55/---/EIP).

10.1 Overview

This document outline the conformance of the Ethernet/IP and CIP stack implemented in the servodrive; the following documents applies except otherwise stated:

- CIP Network library – Volume 1 (edition 3.3, november 2007)
- CIP Network library – Volume 2; Ethernet/IP adaptation of CIP (edition 1.4, november 2007)
- CiA DS402 v3.0.1.15

Furthermore the CiA DS402 adaptation to CIP are described in the relevant section.

10.2 CIP Objects

The servodrive implements the following objects of the CIP object model:

- CIP common objects
    - Identity object – 01h
    - Assembly object – 04h
    - TCP object – F5h
    - Ethernet object – F6h;

- Manufactor specific objects
    - COM object – 0x64
    - PAR object – 0x65
    - MISC object – 0x66
    - CIA402 objects – 0x67

Furthermore the following ASSEMBLIES contains process data:

- O>>T: Assembly 0x64
- T>>O: Assembly 0x65
- CFG: Assembly 0x66

10.2.1 COM object – 0x64

Instance	Attribute ID	Name	Data Type	Unit meas.	Access
0x0	0x01	Revision	UINT		RO
0x1	0x01	Software edition	UINT		RO
	0x02	Software CRC	UDINT		RO
	0x10	Save parameters NOTE: to save parameter, value 0x65766173 should be written	UDINT		RO

10.2.2 PAR object – 0x65

Instance	Attribute ID	Name	Data Type	Unit meas.	Access
0x0	0x01	Revision	UINT		RO
0x1	0x00	P000	UINT	(*1)	RW
	0x01	P001	UINT	(*1)	RW
	...				
	0xFF	P255	UINT	(*1)	RW
0x2	0x00	P256	UINT	(*1)	RW
	0x01	P257	UINT	(*1)	RW
	...				
	0xFF	P511	UINT	(*1)	RW

(*1): please refer to the parameter list for actual meaning of the parameters.

Special parameters

- Appl>Fieldbus>CIP>P170-IpAddr
  This parameter is the ip address for the CIP module; since IP address is 32bit wide and normal parameters are 16bit wide, two parameters are actually used:
  - o Parameter n.170: 16 most-significant word of IP address
  - o Parameter n.171: 16 least significant word of IP address
- Appl>Fieldbus>CIP>P172-IpMask
  IP net mask for CIP module, analogous to IP address:
  - o Parameter n.172: 16 most-significant word of IP net-mask
  - o Parameter n.173: 16 least significant word of IP net-mask
- Appl>Fieldbus>CIP>P174-IpGateway
  Ip gateway address; used only whenever IP routing is used (not used if master/slave are in the same subnet)
  - o Parameter n.174: 16 most-significant word of IP gateway
  - o Parameter n.175: 16 least significant word of IP gateway

10.2.3 MISC object – 0x66

Instance	Attribute ID	Name	Data Type	Unit meas.	Access
0x0	0x01	Revision	UINT		RO
0x30 (48)	0x00	Analog input 0	UINT		RO
	0x01	Digital inputs	UINT		RO
	0x02	Digital outputs	UINT		RW
	0x03	Heatsink temperature	UINT	0.1 °C	RO
	0x05	Board temperature	UINT	0.1 °C	RO
	0x08	Actual Alarm	UINT	N/A	RO
	0x10	Dclink voltage	UINT	0.1 V	RO
	0x11	Current actual value	UINT	mA	RO
	0x12	Current limit for PP/PV/PT	UINT	mA	RO

10.2.4 CIA402 object – 0x67

Instance	Attr. ID	Name	Data Type	Unit meas.	Access
0x0	0x01	Revision	UINT	-	RO
0x60 (96)	0x40	Control word	UINT	-	RW
	0x41	Status word	UINT	-	RO
	0x5A	Quick-stop option code	INT	-	RW
	0x5C	DIsable operation option code	INT	-	RW
	0x5E	Fault reaction code	INT	-	RW
	0x60	Mode of operation	SINT	-	RW
	0x64	Position actual value	DINT	pulses	RO
	0x65	Following error window	DINT	pulses	RW
	0x66	Following error time	INT	ms	RW
	0x67	Position window	DINT	pulses	RW
	0x68	Position window time	INT	ms	RW
	0x6C	Velocity actual value	DINT	rpm	RO
	0x6D	Velocity window	DINT	rpm	RW
	0x6E	Velocity window time	INT	ms	RW
	0x6F	Velocity threshold	DINT	rpm	RW
	0x70	Velocity threshold time	INT	ms	RW
	0x71	Target torque	INT	thousand-th of rated	RW
	0x72	Max torque	INT	thousand-th of rated	RW
	0x73	Max current	INT	thousand-th of rated	RW
	0x75	Motor rated current	DINT	milliA	RO

	0x76	Motor rated torque	DINT	milliNm	RO
	0x77	Torque actual value	INT	thousand-th of rated	RO
	0x78	Current actual value	INT	thousand-th of rated	RO
	0x7A	Target position	DINT	pulses	RW
	0x7C	Home offset	DINT	pulses	RW
	0x7D	Position limits index1: min limit index2: max limit	ARRAY[1..2] OF DINT	pulses	RW
	0x7E	Polarity	USINT	-	RW
	0x80	Max motor speed	DINT	rpm	RO
	0x81	Profile velocity	DINT	rpm	RW
	0x83	Profile acceleration	DINT	rpm/s	RW
	0x84	Profile deceleration	DINT	rpm/s	RW
	0x85	Quick stop deceleration	DINT	rpm/s	RW
	0x87	Torque slope	INT	thousandth of rated / s	RW
	0x98	Homing method	SINT		RW
	0x99	Homing speed index1: switch speed index2: index speed	ARRAY[1..2] OF DINT	rpm	RW
	0x9A	Homing acceleration	DINT	rpm/s	RW
	0xFF	Target velocity	DINT	rpm	RW

10.3 Process data

***** DBS55 firmware referenced by this document: ≥v4.036 *****

There are four possible configuration of the Ethernet IP process data.

- Default: the standard process data implementing the profile velocity/torque/position/homing
- A: Standard process data with the possibility to read Digital and Analog inputs and command via fieldbus the Digital Out. The latter needs the parameter P015 on 10-Fieldbus to receive commands.
- B: A process data with the Cia 402 Touch probe functionality
- C: A process data with our manufacturer custom Touch Probe implementation
- D: A process data with acceleration three axis rms values

You must select the corresponding device description and set the parameter P176 to the desired value.

10.4 Layout Default

The configuration for process data is the following:

- Assembly 0x64 (Originator to Target, **DBS55 inputs - PLC outputs**)
  Assembly length : 50bytes

Offset	Type	Attribute	Class	Instance	Attribute	Default	Meaning
0x00	U16	**ControlWord**	0x67	0x60	0x40	0000h	see Dsp402
0x02	S32	**TargetPosition**	0x67	0x60	0x7A	+0	position units
0x06	U16	**TorqueLimit**	0x67	0x60	0x72	1000	x 0.1% Trq
0x08	S32	**TargetVelocity**	0x67	0x60	0xFF	+0	rpm
0x0C	S16	**TargetTorque**	0x67	0x60	0x71	+0	x 0.1% Trq
0x0E	U8	**ModeOfOperation**	0x67	0x60	0x60	1	ProfilePosition see Dsp402
0x0F	U8	**Padding Byte**					
0x10	U32	**ProfileVelocity**	0x67	0x60	0x81	+3000	rpm
0x14	U32	**ProfileAccel**	0x67	0x60	0x83	+3000	rpm/s
0x18	U32	**ProfileDecel**	0x67	0x60	0x84	+3000	rpm/s
0x1C	S32	**PositionLimit.Neg**	0x67	0x60	0x7D.1	-2147483648	position units
0x20	S32	**PositionLimit.Pos**	0x67	0x60	0x7D.2	+2147483647	position units
0x24	S32	**HomingOffset**	0x67	0x60	0x7C	+0	position units
0x28	S8	**HomingMethod**	0x67	0x60	0x98	37	SetQuota see Dsp402

- Assembly 0x65 (Target to Originator, **DBS55 outputs - PLC inputs**)
  Assembly length : 20bytes

Offset	Type	Attribute	Class	Instance	Attribute	Default	Meaning
0x00	U16	**StatusWord**	0x67	0x60	0x41	0250h	see Dsp402
0x02	S32	**PositionActualValue**	0x67	0x60	0x64	+0	position units
0x06	S16	**TorqueActualValue**	0x67	0x60	0x77	+0	x 0.1% Trq

0x08	S32	**VelocityActualValue**	0x67	0x60	0x6C	+0	rpm
0x0C	U16	**VDclink**	0x67	0x30	0x10	+0	x 0.1V
0x0E	U8	**ModeOfOperation**	0x67	0x60	0x60	1	see Dsp402
0x0F	U8	**Padding Byte**					
0x10	U16	**ActualAlarm**	0x67	0x30	0x08	0	see DBS Manual

10.5 Layout A

The configuration for process data is the following:

- Assembly 0x64 (Originator to Target, **DBS55 inputs - PLC outputs**)
  Assembly length : 50bytes

Offset	Type	Attribute	Class	Instance	Attribute	Default	Meaning
0x00	U16	**ControlWord**	0x67	0x60	0x40	0000h	see Dsp402
0x02	S32	**TargetPosition**	0x67	0x60	0x7A	+0	position units
0x06	U16	**TorqueLimit**	0x67	0x60	0x72	1000	x 0.1% Trq
0x08	S32	**TargetVelocity**	0x67	0x60	0xFF	+0	rpm
0x0C	S16	**TargetTorque**	0x67	0x60	0x71	+0	x 0.1% Trq
0x0E	U8	**ModeOfOperation**	0x67	0x60	0x60	1	ProfilePosition see Dsp402
0x0F	U8	**Padding Byte**					
0x0F	U8	**Padding Byte**					
0x10	U32	**ProfileVelocity**	0x67	0x60	0x81	+3000	rpm
0x14	U32	**ProfileAccel**	0x67	0x60	0x83	+3000	rpm/s
0x18	U32	**ProfileDecel**	0x67	0x60	0x84	+3000	rpm/s
0x1C	S32	**PositionLimit.Neg**	0x67	0x60	0x7D.1	-2147483648	position units
0x20	S32	**PositionLimit.Pos**	0x67	0x60	0x7D.2	+2147483647	position units
0x24	S32	**HomingOffset**	0x67	0x60	0x7C	+0	position units
0x28	S8	**HomingMethod**	0x67	0x60	0x98	37	SetQuota see Dsp402
0x29	U8	**Padding Byte**					
0x2A	U16	**Digital output**	0x67	0x30	0x02	0	bit0: DOUT1 bit1..15: not used *Note: P015=10 required for fieldbus operation*

- Assembly 0x65 (Target to Originator, **DBS55 outputs - PLC inputs**)
  Assembly length : 30bytes

Offset	Type	Attribute	Class	Instance	Attribute	Default	Meaning
0x00	U16	**StatusWord**	0x67	0x60	0x41	0250h	see Dsp402
0x02	S32	**PositionActualValue**	0x67	0x60	0x64	+0	position units
0x06	S16	**TorqueActualValue**	0x67	0x60	0x77	+0	x 0.1% Trq
0x08	S32	**VelocityActualValue**	0x67	0x60	0x6C	+0	rpm
0x0C	U16	**VDclink**	0x67	0x30	0x10	+0	x 0.1V

0x0E	U8	**ModeOfOperation**	0x67	0x60	0x60	1	see Dsp402
0x0F	U8	**Padding Byte**					
0x10	U16	**ActualAlarm**	0x67	0x30	0x08	0	see DBS Manual
0x12	S16	**Analog Input**	0x67	0x30	0x00	+0	-32768 ... 32767
0x14	U16	**Digital Input**	0x67	0x30	0x01	0	Bit0: DIN1 Bit1: DIN2 Bit2: DIN3 Bit3: DIN4 Bit4: DIN5 Bit5..15: not used

10.6 Layout B

The configuration for process data is the following:

- Assembly 0x64 (Originator to Target, **DBS55 inputs - PLC outputs**)
  Assembly length : 50bytes

Offset	Type	Attribute	Class	Instance	Attribute	Default	Meaning
0x00	U16	**ControlWord**	0x67	0x60	0x40	0000h	see Dsp402
0x02	S32	**TargetPosition**	0x67	0x60	0x7A	+0	position units
0x06	U16	**TorqueLimit**	0x67	0x60	0x72	1000	x 0.1% Trq
0x08	S32	**TargetVelocity**	0x67	0x60	0xFF	+0	rpm
0x0C	S16	**TargetTorque**	0x67	0x60	0x71	+0	x 0.1% Trq
0x0E	U8	**ModeOfOperation**	0x67	0x60	0x60	1	ProfilePosition see Dsp402
0x0F	U8	**Padding Byte**					
0x10	U32	**ProfileVelocity**	0x67	0x60	0x81	+3000	rpm
0x14	U32	**ProfileAccel**	0x67	0x60	0x83	+3000	rpm/s
0x18	U32	**ProfileDecel**	0x67	0x60	0x84	+3000	rpm/s
0x1C	S32	**PositionLimit.Neg**	0x67	0x60	0x7D.1	-2147483648	position units
0x20	S32	**PositionLimit.Pos**	0x67	0x60	0x7D.2	+2147483647	position units
0x24	S32	**HomingOffset**	0x67	0x60	0x7C	+0	position units
0x28	S8	**HomingMethod**	0x67	0x60	0x98	37	SetQuota see Dsp402
0x29	U8	**Padding Byte**					
0x2A	U16	**Digital output**	0x67	0x30	0x02	0	bit0: DOUT1 bit1..15: not used *Note: P015=10 required for fieldbus operation*
0x2C	U16	**TouchProbe function**	0x67	0x60	0xB8	0	see Cia402

- Assembly 0x65 (Target to Originator, **DBS55 outputs - PLC inputs**)
  Assembly length : 40bytes

Offset	Type	Attribute	Class	Instance	Attribute	Default	Meaning
0x00	U16	**StatusWord**	0x67	0x60	0x41	0250h	see Dsp402
0x02	S32	**PositionActualValue**	0x67	0x60	0x64	+0	position units
0x06	S16	**TorqueActualValue**	0x67	0x60	0x77	+0	x 0.1% Trq
0x08	S32	**VelocityActualValue**	0x67	0x60	0x6C	+0	rpm
0x0C	U16	**VDclink**	0x67	0x30	0x10	+0	x 0.1V
0x0E	U8	**ModeOfOperation**	0x67	0x60	0x60	1	see Dsp402
0x0F	U8	**Padding Byte**					
0x10	U16	**ActualAlarm**	0x67	0x30	0x08	0	see DBS Manual
0x12	S16	**Analog Input**	0x67	0x30	0x00	+0	-32768 ... 32767
0x14	U16	**Digital Input**	0x67	0x30	0x01	0	Bit0: DIN1 Bit1: DIN2 Bit2: DIN3 Bit3: DIN4 Bit4: DIN5 Bit5..15: not used
0x16	U16	**TouchProbe status**	0x67	0x60	0xB8	0	see Cia402
0x18	S32	**TouchProbe rising edge position**	0x67	0x60	0xBA	+0	position units
0x1C	S32	**TouchProbe falling edge position**	0x67	0x60	0xBB	+0	position units

10.7 Layout C

The configuration for process data is the following:

- Assembly 0x64 (Originator to Target, **DBS55 inputs - PLC outputs**)
  Assembly length : 60bytes

Offset	Type	Attribute	Class	Instance	Attribute	Default	Meaning
0x00	U16	**ControlWord**	0x67	0x60	0x40	0000h	see Dsp402
0x02	S32	**TargetPosition**	0x67	0x60	0x7A	+0	position units
0x06	U16	**TorqueLimit**	0x67	0x60	0x72	1000	x 0.1% Trq
0x08	S32	**TargetVelocity**	0x67	0x60	0xFF	+0	rpm
0x0C	S16	**TargetTorque**	0x67	0x60	0x71	+0	x 0.1% Trq
0x0E	U8	**ModeOfOperation**	0x67	0x60	0x60	1	ProfilePosition see Dsp402
0x0F	U8	**Padding Byte**					
0x10	U32	**ProfileVelocity**	0x67	0x60	0x81	+3000	rpm
0x14	U32	**ProfileAccel**	0x67	0x60	0x83	+3000	rpm/s
0x18	U32	**ProfileDecel**	0x67	0x60	0x84	+3000	rpm/s
0x1C	S32	**PositionLimit.Neg**	0x67	0x60	0x7D.1	-2147483648	position units
0x20	S32	**PositionLimit.Pos**	0x67	0x60	0x7D.2	+2147483647	position units
0x24	S32	**HomingOffset**	0x67	0x60	0x7C	+0	position units
0x28	S8	**HomingMethod**	0x67	0x60	0x98	37	SetQuota see Dsp402

0x29	U8	**Padding Byte**					
0x2A	U16	**Digital output**	0x67	0x30	0x02	0	bit0: DOUT1 bit1..15: not used *Note: P015=10 required for fieldbus operation*
0x2C	S32	**TouchProbe positioning offset**	0x67	0x30	0x20	+0	Position units
0x30	U32	**Touchprobe position. modulo**	0x67	0x30	0x21	4096	Position units

- Assembly 0x65 (Target to Originator, **DBS55 outputs - PLC inputs**)
  Assembly length : 30bytes

Offset	Type	Attribute	Class	Instance	Attribute	Default	Meaning
0x00	U16	**StatusWord**	0x67	0x60	0x41	0250h	see Dsp402
0x02	S32	**PositionActualValue**	0x67	0x60	0x64	+0	position units
0x06	S16	**TorqueActualValue**	0x67	0x60	0x77	+0	x 0.1% Trq
0x08	S32	**VelocityActualValue**	0x67	0x60	0x6C	+0	rpm
0x0C	U16	**VDclink**	0x67	0x30	0x10	+0	x 0.1V
0x0E	U8	**ModeOfOperation**	0x67	0x60	0x60	1	see Dsp402
0x0F	U8	**Padding Byte**					
0x10	U16	**ActualAlarm**	0x67	0x30	0x08	0	see DBS Manual
0x12	S16	**Analog Input**	0x67	0x30	0x00	+0	-32768 ... 32767
0x14	U16	**Digital Input**	0x67	0x30	0x01	0	Bit0: DIN1 Bit1: DIN2 Bit2: DIN3 Bit3: DIN4 Bit4: DIN5 Bit5..15: not used

10.8 Layout D

Assembly 0x64 (Originator to Target, **DBS55 inputs - PLC outputs**)

1. Assembly length : 50bytes

Offset	Type	Attribute	Class	Instance	Attribute	Default	Meaning
0x00	U16	**ControlWord**	0x67	0x60	0x40	0000h	see Dsp402
0x02	S32	**TargetPosition**	0x67	0x60	0x7A	+0	position units
0x06	U16	**TorqueLimit**	0x67	0x60	0x72	1000	x 0.1% Trq
0x08	S32	**TargetVelocity**	0x67	0x60	0xFF	+0	rpm
0x0C	S16	**TargetTorque**	0x67	0x60	0x71	+0	x 0.1% Trq
0x0E	U8	**ModeOfOperation**	0x67	0x60	0x60	1	ProfilePosition see Dsp402
0x0F	U8	**Padding Byte**					
0x10	U32	**ProfileVelocity**	0x67	0x60	0x81	+3000	rpm
0x14	U32	**ProfileAccel**	0x67	0x60	0x83	+3000	rpm/s
0x18	U32	**ProfileDecel**	0x67	0x60	0x84	+3000	rpm/s

0x1C	S32	**PositionLimit.Neg**	0x67	0x60	0x7D.1	-2147483648	position units
0x20	S32	**PositionLimit.Pos**	0x67	0x60	0x7D.2	+2147483647	position units
0x24	S32	**HomingOffset**	0x67	0x60	0x7C	+0	position units
0x28	S8	**HomingMethod**	0x67	0x60	0x98	37	SetQuota see Dsp402
0x29	U8	**Padding Byte**					
0x2A	U16	**Digital output**	0x67	0x30	0x02	0	bit0: DOUT1 bit1..15: not used *Note: P015=10 required for fieldbus operation*

2. Assembly 0x65 (Target to Originator, **DBS55 outputs - PLC inputs**)
   Assembly length : 30bytes

Offset	Type	Attribute	Class	Instance	Attribute	Default	Meaning
0x00	U16	**StatusWord**	0x67	0x60	0x41	0250h	see Dsp402
0x02	S32	**PositionActualValue**	0x67	0x60	0x64	+0	position units
0x06	S16	**TorqueActualValue**	0x67	0x60	0x77	+0	x 0.1% Trq
0x08	S32	**VelocityActualValue**	0x67	0x60	0x6C	+0	rpm
0x0C	U16	**VDclink**	0x67	0x30	0x10	+0	x 0.1V
0x0E	U8	**ModeOfOperation**	0x67	0x60	0x60	1	see Dsp402
0x0F	U8	**Padding Byte**					
0x10	U16	**ActualAlarm**	0x67	0x30	0x08	0	see DBS Manual
0x12	S16	**Analog Input**	0x67	0x30	0x00	+0	-32768 ... 32767
0x14	U16	**Digital Input**	0x67	0x30	0x01	0	Bit0: DIN1 Bit1: DIN2 Bit2: DIN3 Bit3: DIN4 Bit4: DIN5 Bit5..15: not used
0X16	U16	**Acceleration rms x (milli-G)**	0x67	0x30	0x31	-	
0x18	U16	**Acceleration rms y (milli-G)**	0x67	0x30	0x32	-	
0x1A	U16	**Acceleration rms z (milli-G)**	0x67	0x30	0x33	-	

11 ProfiNET

Note: available only for drivers equipped with ProfiNET optional board (55/---/EPN).

11.1 Overview

This document outline the details of the Profinet implementation for Minimotor DBS55 integrated servomotor. By enabling Profinet/DSP402 “reference mode”, the servodrive is commanded by means of CanOPEN DSP402 state machine and profiles.

For further information, please refer to:

- DBS55 user manual: information about parametrization through USB and PC interface
- Dsp402 v3: information about device state machine, control word/status word encoding and object dictionary.

***** DBS55 firmware referenced by this document: ≥v4.036 *****

11.2 Device identity

- Vendor_ID: 0x0419
- Device_ID: 0x0001

11.3 Process Data

There are four possible configuration of the Ethernet IP process data.

- Default: the standard process data implementing the profile velocity/torque/position/homing
- A: Standard process data with the possibility to read Digital and Analog inputs and command via fieldbus the Digital Out. Parameter P015 must be on 10-Fieldbus.
- B: A process data with the Cia 402 Touch probe functionality
- C: A process data with our manufacturer custom Touch Probe implementation
- D: A process data with rms acceleration values of the three axis

You must select the corresponding device description and set the P176 parameter to the desired value.

11.4 Process data – Default layout

- PLC Inputs (18byte)

Offset	Type	Attribute	CIA402 object	Default	Meaning
0x00	U16	**StatusWord**	6041h.0	0250h	see Cia402
0x02	S32	**PositionActualValue**	6064h.0	+0	position units
0x06	S16	**TorqueActualValue**	6077h.0	+0	x 0.1% Trq
0x08	S32	**VelocityActualValue**	606Ch.0	+0	rpm
0x0C	U16	**VDclink**	3010h.0	+0	x 0.1V
0x0E	U8	**ModeOfOperDisplay**	6061h.0	1	see Cia402
0x0F	U8	** not used **	-	-	-
0x10	U16	**ActualAlarm**	3008h.0	0	see alarm table

- PLC Outputs (42byte)

Offset	Type	Attribute	CIA402 object	Default	Meaning
0x00	U16	**ControlWord**	6040h.0	0000h	see Cia402
0x02	S32	**TargetPosition**	607Ah.0	+0	position units
0x06	U16	**TorqueLimit**	6073h.0	1000	x 0.1% Trq
0x08	S32	**TargetVelocity**	60FFh.0	+0	rpm
0x0C	S16	**TargetTorque**	6071h.0	+0	x 0.1% Trq
0x0E	U8	**ModeOfOper**	6060h.0	1	see Cia402
0x0F	U8	** not used **	-	-	-
0x10	U32	**ProfileVelocity**	6081h.0	P006	rpm
0x14	U32	**ProfileAcc**	6083h.0	P008	rpm/s
0x18	U32	**ProfileDec**	6084h.0	P009	rpm/s
0x1C	S32	**Negative Pos Limit**	607Dh.1	-2^31	position units
0x20	S32	**Positive Pos Limit**	607Dh.2	+2^31-1	position units
0x24	S32	**Homing offset**	607Ch.0	+0	position units
0x28	U8	**Homing method**	6098h.0	37	see Cia402
0x29	U8	** not used **	-	-	-

11.5 Process data – Layout A

- PLC Inputs (22byte)

Offset	Type	Attribute	CIA402 object	Default	Meaning
0x00	U16	**StatusWord**	6041h.0	0250h	see Cia402
0x02	S32	**PositionActualValue**	6064h.0	+0	position units
0x06	S16	**TorqueActualValue**	6077h.0	+0	x 0.1% Trq
0x08	S32	**VelocityActualValue**	606Ch.0	+0	rpm
0x0C	U16	**VDclink**	3010h.0	+0	x 0.1V
0x0E	U8	**ModeOfOperDisplay**	6061h.0	1	see Cia402
0x0F	U8	** not used **	-	-	-
0x10	U16	**ActualAlarm**	3008h.0	0	see alarm table
0x12	S16	**Analog Input**	3000h.0	0	-32768 ... 32767
0x14	U16	**Digital Input**	3001h.0	0	Bit0: DIN1 Bit1: DIN2 Bit2: DIN3 Bit3: DIN4 Bit4: DIN5 Bit5..15: not used

- PLC Outputs (44byte)

Offset	Type	Attribute	CIA402 object	Default	Meaning
0x00	U16	**ControlWord**	6040h.0	0000h	see Cia402
0x02	S32	**TargetPosition**	607Ah.0	+0	position units
0x06	U16	**TorqueLimit**	6073h.0	1000	x 0.1% Trq
0x08	S32	**TargetVelocity**	60FFh.0	+0	rpm
0x0C	S16	**TargetTorque**	6071h.0	+0	x 0.1% Trq
0x0E	U8	**ModeOfOper**	6060h.0	1	see Cia402
0x0F	U8	** not used **	-	-	-
0x10	U32	**ProfileVelocity**	6081h.0	P006	rpm
0x14	U32	**ProfileAcc**	6083h.0	P008	rpm/s
0x18	U32	**ProfileDec**	6084h.0	P009	rpm/s
0x1C	S32	**Negative Pos Limit**	607Dh.1	-2^31	position units
0x20	S32	**Positive Pos Limit**	607Dh.2	+2^31-1	position units
0x24	S32	**Homing offset**	607Ch.0	+0	position units
0x28	U8	**Homing method**	6098h.0	37	see Cia402
0x29	U8	** not used **	-	-	-
0x2A	U16	**Digital outputs**	3002h.0	0	bit0: DOUT1 bit1..15: not used *Note: P015=10 required for fieldbus operation*

11.6 Process data – Layout B

- PLC Inputs (32byte)

Offset	Type	Attribute	CIA402 object	Default	Meaning
0x00	U16	**StatusWord**	6041h.0	0250h	see Cia402

0x02	S32	**PositionActualValue**	6064h.0	+0	position units
0x06	S16	**TorqueActualValue**	6077h.0	+0	x 0.1% Trq
0x08	S32	**VelocityActualValue**	606Ch.0	+0	rpm
0x0C	U16	**VDclink**	3010h.0	+0	x 0.1V
0x0E	U8	**ModeOfOperDisplay**	6061h.0	1	see Cia402
0x0F	U8	**** not used ****	-	-	-
0x10	U16	**ActualAlarm**	3008h.0	0	see alarm table
0x12	S16	**Analog Input**	3000h.0	0	-32768 ... 32767
0x14	U16	**Digital Input**	3001h.0	0	Bit0: DIN1 Bit1: DIN2 Bit2: DIN3 Bit3: DIN4 Bit4: DIN5 Bit5..15: not used
0x16	U16	**TouchProbe status**	60B9h.0	0	see Cia402
0x18	S32	**TouchProbe rising edge position**	60BAh.0	0	position units
0x1C	S32	**TouchProbe falling edge position**	60BBh.0	0	position units

- PLC Outputs (46byte)

Offset	Type	Attribute	CIA402 object	Default	Meaning
0x00	U16	**ControlWord**	6040h.0	0000h	see Cia402
0x02	S32	**TargetPosition**	607Ah.0	+0	pulses
0x06	U16	**TorqueLimit**	6073h.0	1000	x 0.1% Trq
0x08	S32	**TargetVelocity**	60FFh.0	+0	rpm
0x0C	S16	**TargetTorque**	6071h.0	+0	x 0.1% Trq
0x0E	U8	**ModeOfOper**	6060h.0	1	see Cia402
0x0F	U8	**** not used ****	-	-	-
0x10	U32	**ProfileVelocity**	6081h.0	P006	rpm
0x14	U32	**ProfileAcc**	6083h.0	P008	rpm/s
0x18	U32	**ProfileDec**	6084h.0	P009	rpm/s
0x1C	S32	**Negative Pos Limit**	607Dh.1	-2^31	position units
0x20	S32	**Positive Pos Limit**	607Dh.2	+2^31-1	position units
0x24	S32	**Homing offset**	607Ch.0	+0	position units
0x28	U8	**Homing method**	6098h.0	37	see Cia402
0x29	U8	**** not used ****	-	-	-
0x2A	U16	**Digital outputs**	3002h.0	0	bit0: DOUT1 bit1..15: not used *Note: P015=10 required for fieldbus operation*
0x2C	U16	**TouchProbe function**	60B8h.0	0	see Cia402

11.7 Process data –Layout C

- PLC Inputs (22byte)

Offset	Type	Attribute	CIA402 object	Default	Meaning
0x00	U16	**StatusWord**	6041h.0	0250h	see Cia402
0x02	S32	**PositionActualValue**	6064h.0	+0	position units
0x06	S16	**TorqueActualValue**	6077h.0	+0	x 0.1% Trq
0x08	S32	**VelocityActualValue**	606Ch.0	+0	rpm
0x0C	U16	**VDclink**	3010h.0	+0	x 0.1V
0x0E	U8	**ModeOfOperDisplay**	6061h.0	1	see Cia402
0x0F	U8	** not used **	-	-	-
0x10	U16	**ActualAlarm**	3008h.0	0	see alarm table
0x12	S16	**Analog Input**	3000h.0	0	-32768 ... 32767
0x14	U16	**Digital Input**	3001h.0	0	Bit0: DIN1 Bit1: DIN2 Bit2: DIN3 Bit3: DIN4 Bit4: DIN5 Bit5..15: not used

- PLC Outputs (52byte)

Offset	Type	Attribute	CIA402 object	Default	Meaning
0x00	U16	**ControlWord**	6040h.0	0000h	see Cia402
0x02	S32	**TargetPosition**	607Ah.0	+0	pulses
0x06	U16	**TorqueLimit**	6073h.0	1000	x 0.1% Trq
0x08	S32	**TargetVelocity**	60FFh.0	+0	rpm
0x0C	S16	**TargetTorque**	6071h.0	+0	x 0.1% Trq
0x0E	U8	**ModeOfOper**	6060h.0	1	see Cia402
0x0F	U8	** not used **	-	-	-
0x10	U32	**ProfileVelocity**	6081h.0	P006	rpm
0x14	U32	**ProfileAcc**	6083h.0	P008	rpm/s
0x18	U32	**ProfileDec**	6084h.0	P009	rpm/s
0x1C	S32	**Negative Pos Limit**	607Dh.1	-2^31	position units
0x20	S32	**Positive Pos Limit**	607Dh.2	+2^31-1	position units
0x24	S32	**Homing offset**	607Ch.0	+0	position units
0x28	U8	**Homing method**	6098h.0	37	see Cia402
0x29	U8	** not used **	-	-	-
0x2A	U16	**Digital outputs**	3002h.0	0	bit0: DOUT1 bit1..15: not used *Note: P015=10 required for fieldbus operation*
0x2C	S32	**TouchProbe positioning offset**	3020h.0	0	position units
0x30	U32	**TouchProbe positioning modulo**	3021h.0	0	position units

11.8 Process data – Layout D

- PLC inputs (28bytes)

Offset	Type	Attribute	Class	Instance	Attribute	Default	Meaning
0x00	U16	**StatusWord**	0x67	0x60	0x41	0250h	see Dsp402
0x02	S32	**PositionActualValue**	0x67	0x60	0x64	+0	position units
0x06	S16	**TorqueActualValue**	0x67	0x60	0x77	+0	x 0.1% Trq
0x08	S32	**VelocityActualValue**	0x67	0x60	0x6C	+0	rpm
0x0C	U16	**VDclink**	0x67	0x30	0x10	+0	x 0.1V
0x0E	U8	**ModeOfOperation**	0x67	0x60	0x60	1	see Dsp402
0x0F	U8	** not used **					
0x10	U16	**ActualAlarm**	0x67	0x30	0x08	0	see DBS Manual
0x12	S16	**Analog Input**	0x67	0x30	0x00	+0	-32768 ... 32767
0x14	U16	**Digital Input**	0x67	0x30	0x01	0	Bit0: DIN1 Bit1: DIN2 Bit2: DIN3 Bit3: DIN4 Bit4: DIN5 Bit5..15: not used
0X16	U16	**Acceleration rms x (milli-G)**	0x67	0x30	0x31	-	
0x18	U16	**Acceleration rms y (milli-G)**	0x67	0x30	0x32	-	
0x1A	U16	**Acceleration rms z (milli-G)**	0x67	0x30	0x33	-	

- PLC outputs (44bytes)

Offset	Type	Attribute	Class	Instance	Attribute	Default	Meaning
0x00	U16	**ControlWord**	0x67	0x60	0x40	0000h	see Dsp402
0x02	S32	**TargetPosition**	0x67	0x60	0x7A	+0	position units
0x06	U16	**TorqueLimit**	0x67	0x60	0x72	1000	x 0.1% Trq
0x08	S32	**TargetVelocity**	0x67	0x60	0xFF	+0	rpm
0x0C	S16	**TargetTorque**	0x67	0x60	0x71	+0	x 0.1% Trq
0x0E	U8	**ModeOfOperation**	0x67	0x60	0x60	1	ProfilePosition see Dsp402
0x0F	U8	** not used **					
0x10	U32	**ProfileVelocity**	0x67	0x60	0x81	+3000	rpm
0x14	U32	**ProfileAccel**	0x67	0x60	0x83	+3000	rpm/s
0x18	U32	**ProfileDecel**	0x67	0x60	0x84	+3000	rpm/s
0x1C	S32	**PositionLimit.Neg**	0x67	0x60	0x7D.1	-2147483648	position units
0x20	S32	**PositionLimit.Pos**	0x67	0x60	0x7D.2	+2147483647	position units
0x24	S32	**HomingOffset**	0x67	0x60	0x7C	+0	position units

0x28	S8	**HomingMethod**	0x67	0x60	0x98	37	SetQuota see Dsp402
0x29	U8	**** not used ****					
0x2A	U16	**Digital output**	0x67	0x30	0x02	0	bit0: DOUT1 bit1..15: not used *Note: P015=10 required for fieldbus operation*

12 Homing types

12.1 Type 1: Homing on anticlockwise limit switch and index pulse (resolver zero).

The initial direction of movement is anticlockwise towards the (anticlockwise) limit switch if this is inactive. The reference (home) position is on the first index pulse (resolver zero) to the right of the anticlockwise limit switch, when the value on the latter switches to low.

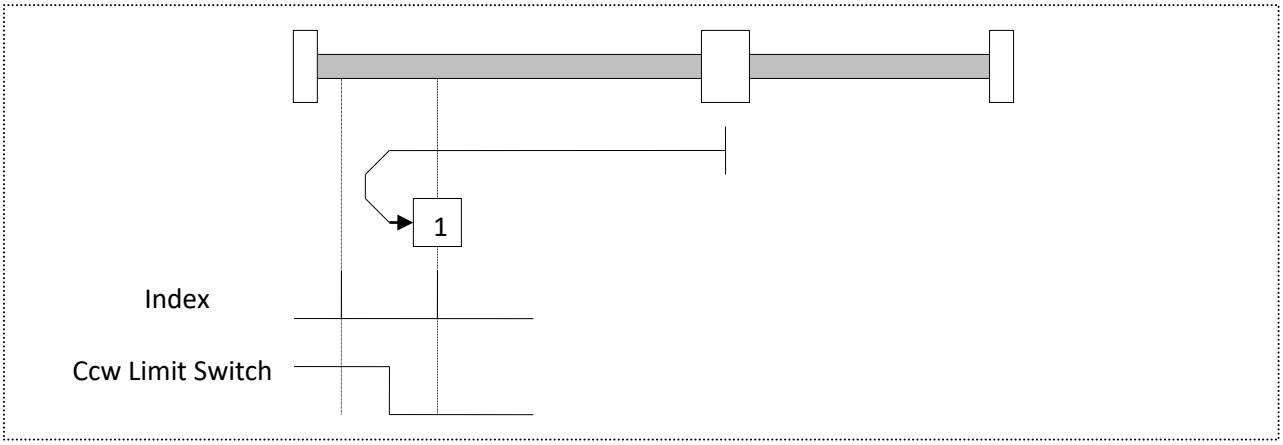


Figure 23

12.2 Type 2: Homing on clockwise limit switch and index pulse (resolver zero)

The initial direction of movement is clockwise towards the (clockwise) limit switch if this is inactive. The reference (home) position is on the first index pulse (resolver zero) to the left of the clockwise limit switch, when the value on the latter switches to low

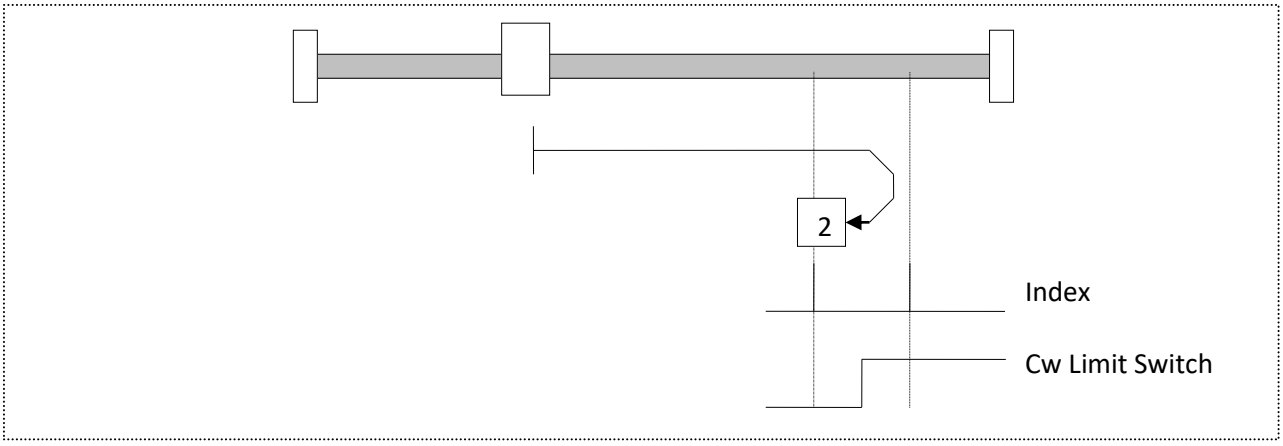


Figure 24

12.3 Type 3 and 4: homing on the positive Home Switch and Index Pulse (resolver zero)

The initial direction of movement depends on the state of the home switch. The reference (home) position is on the index pulse (resolver zero) to the left (type 4) or right (type 3) of the switching point of the home switch. If the starting position is such that a reversal of direction is required, the reversal takes place after the state of the home switch changes.

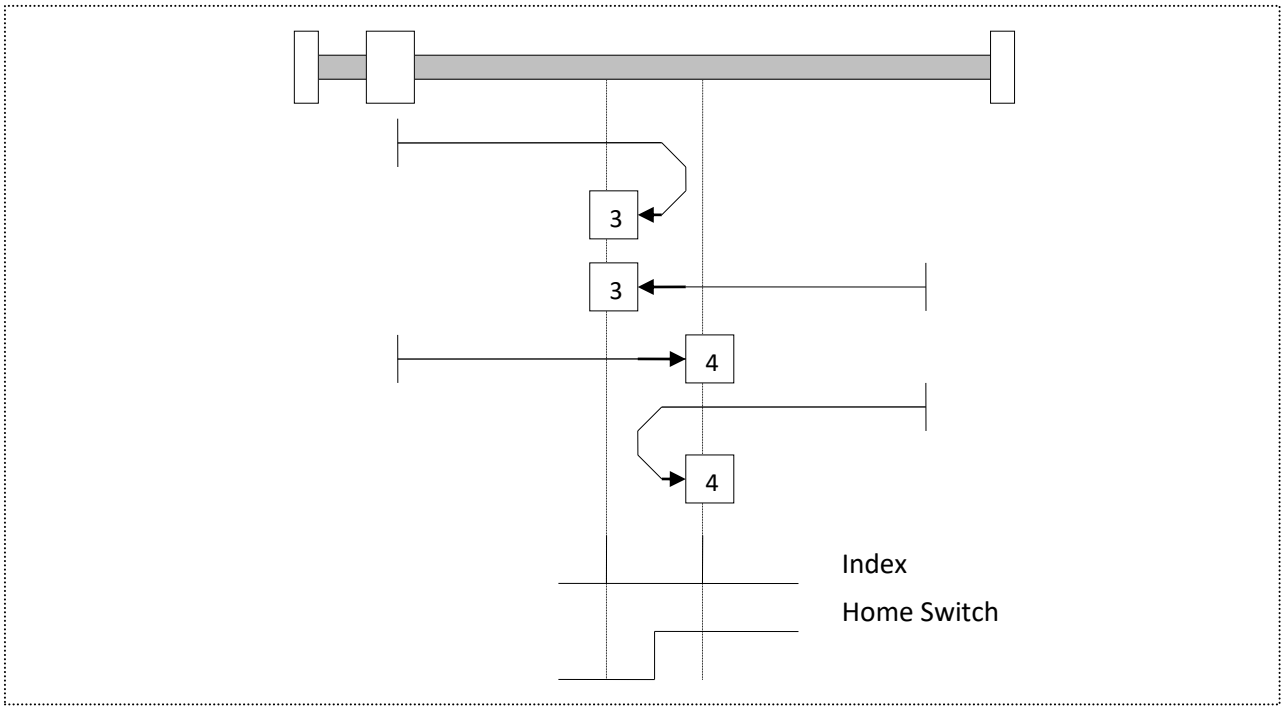


Figure 25

12.4 Type 5 and 6: homing on the negative Home Switch and Index Pulse (resolver zero)

The initial direction of movement depends on the state of the home switch. The reference (home) position is on the index pulse (resolver zero) to the left (type 6) or right (type 5) of the switching point of the home switch. If the starting position is such that a reversal of direction is required, the reversal takes place after the state of the home switch changes

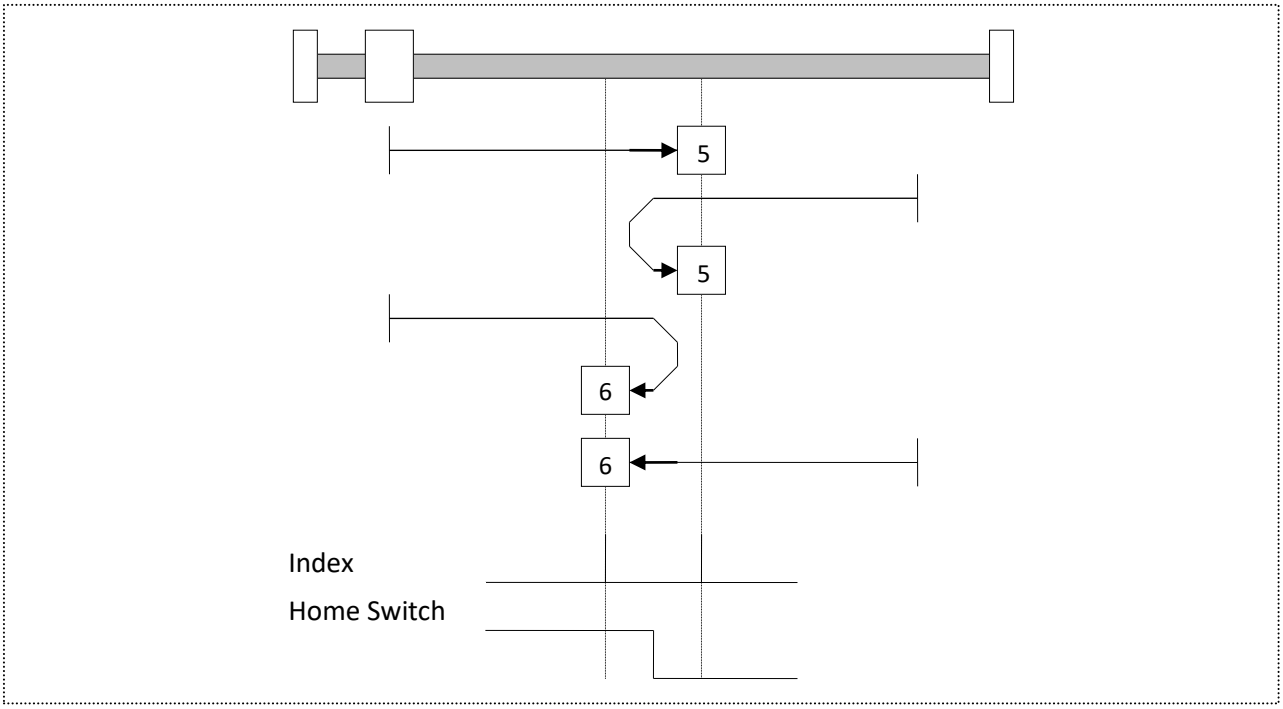


Figure 26

12.5 Type 7, 8, 9, 10, 11, 12, 13, 14: homing on the Home Switch and Index Pulse (resolver zero)

The initial direction of movement is clockwise for types 7 to 10 and anticlockwise for types 11 to 14, except when the Home Switch is high at the beginning of movement. These types of homing procedures use the home switch, which is at a high logic level only for a portion of the excursion. In this case, the initial direction of movement depends on the desired change in state of the home switch. The reference (home) position is on the index pulse (resolver zero) to the left or right of the ascending or descending change in state of the home switch. If the initial direction does not meet the home switch, the direction is reversed toward the limit switch.

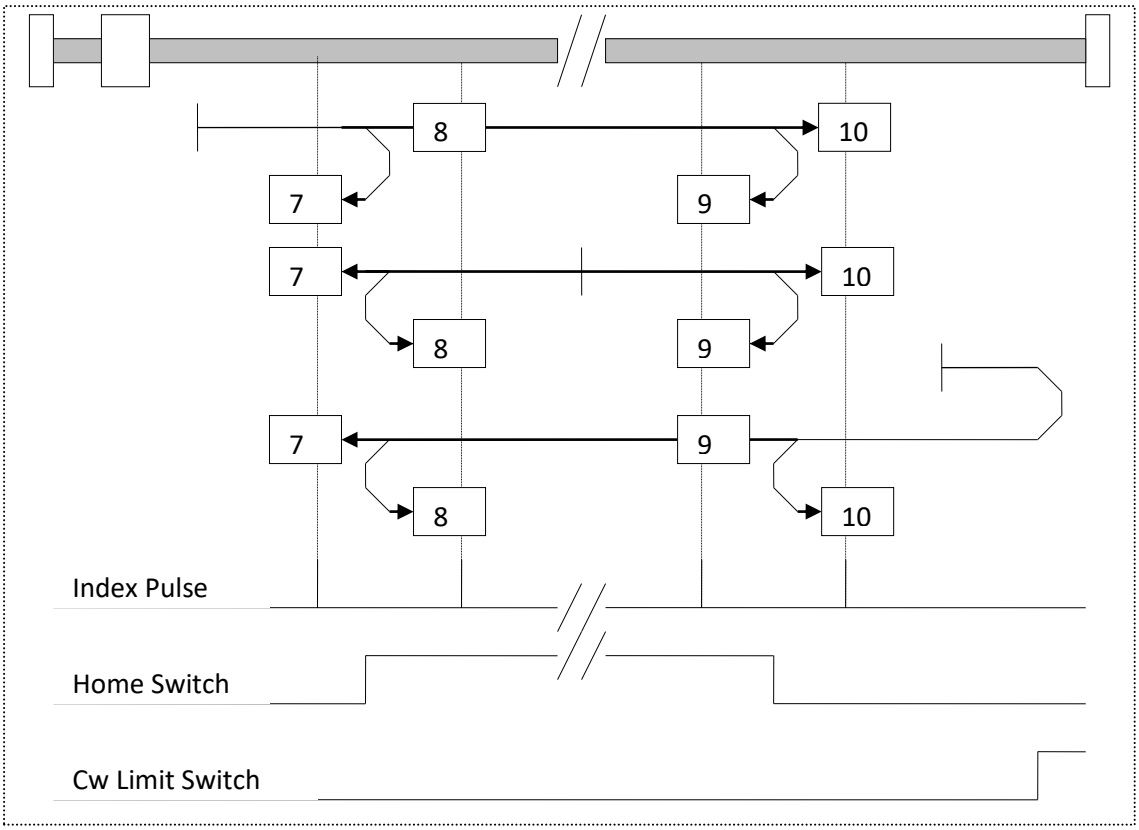


Figure 27

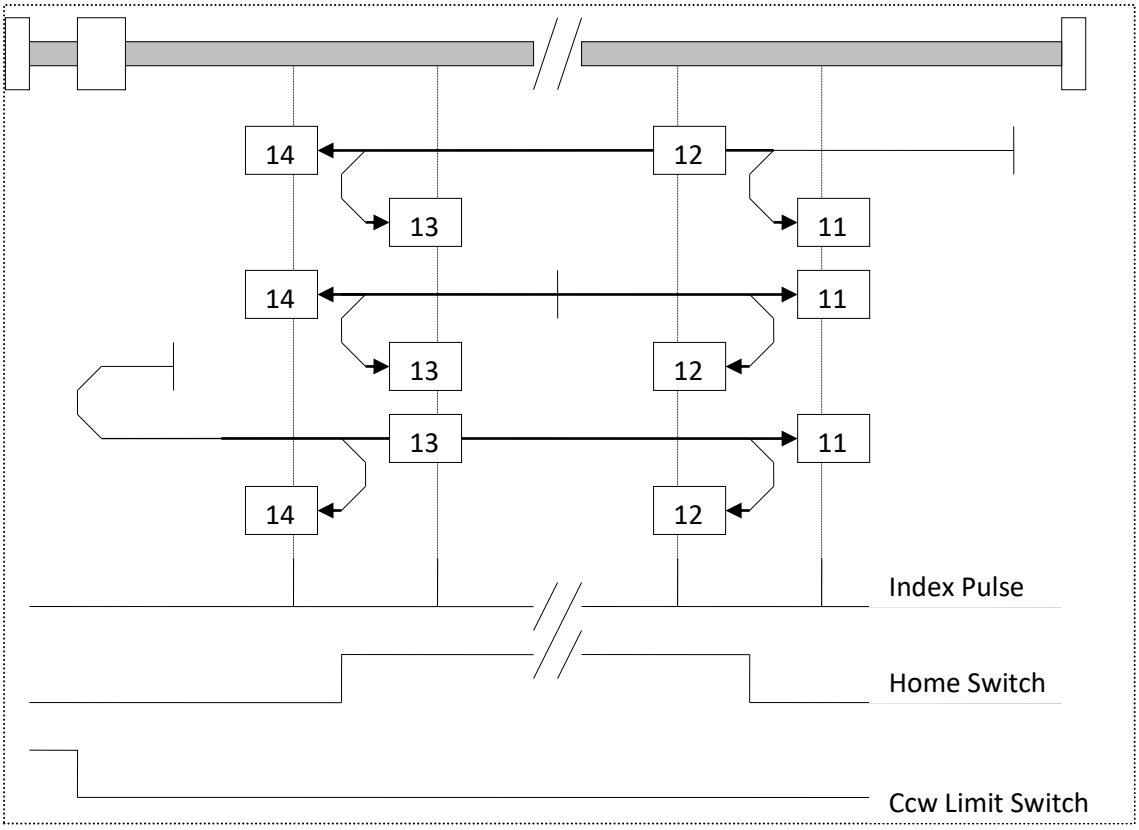


Figure 28

12.6 Types 33 and 34: Homing on Index Pulse (resolver zero).

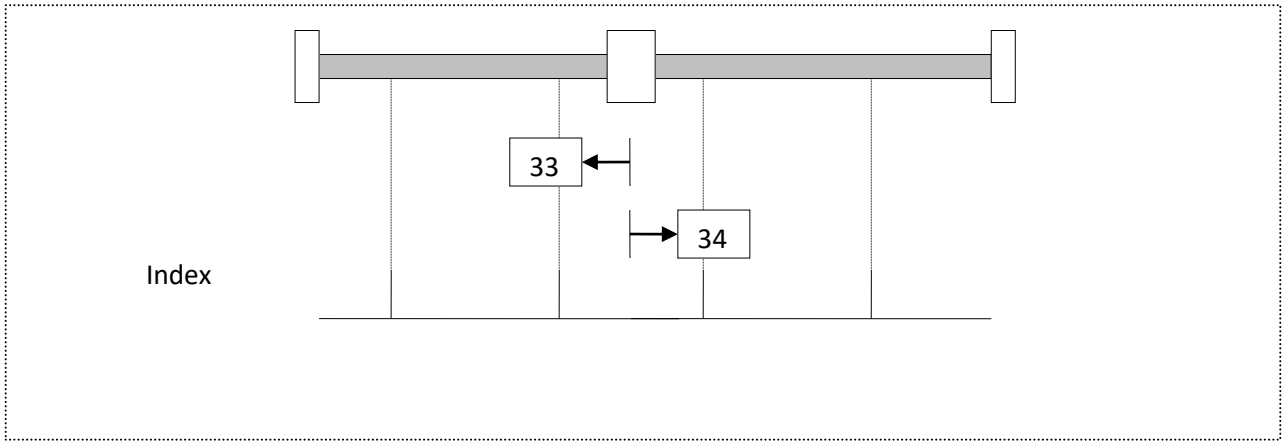


Figure 29

With Homing type 33, initial motion direction is counter clockwise; vice versa, with type 34 it is clockwise. The reference position (Home Position) is on the first Index Pulse (resolver zero) found in the direction selected.

12.7 Type 37: homing in current position.

13 Warranty Conditions

We recommend reading this document closely and ensuring you have understood it before purchasing the product. Contact the manufacturer directly with any queries.

The manufacturer guarantees its products from defects in materials and/or workmanship for a period of **twelve (12) months** (unless otherwise specified in contractual documentation) from the date of delivery. The warranty is limited to repair of the product, or replacement, at the manufacturer's discretion.

The warranty does not cover damage, malfunctions, losses or requests for compensation due to:

- Operational errors in use and/or installation
- Modifications performed by the purchaser
- Unauthorised repairs
- Dropping of the device
- Natural disasters (fire, flood, lightning strikes etc.)
- Incorrect storage and/or maintenance

The burden of proof of any defect (and for any request for assistance in the place of use) lies with the purchaser.

14 Disclaimer

The manufacturer shall not be liable:

- For determining the suitability of the product to meet the customer's needs; this shall remain the responsibility of the customer themselves
- For the use of this product as a safety device for machinery which represents a hazard to persons or property
- For conformity of the product with legislation, standards and regulations applicable to the collection of products required for the purchaser's application. The purchaser shall therefore be responsible for guaranteeing the conformity of their machinery to such standards.

Furthermore:

- The product performance specified in this document does not represent a guarantee but merely a reference for the choice of the most appropriate solution for the purchaser's requirements, as it is the result of the manufacturer's testing conditions
- The product may be subject to modifications in order to make improvements, or for other reasons. Contact the manufacturer to confirm these.
- The information contained in the following document has no contractual validity and may contain omissions, typographical and/or spelling errors, and may therefore be subject to modification and/or updating without notice.

APPENDIX A - Wirings

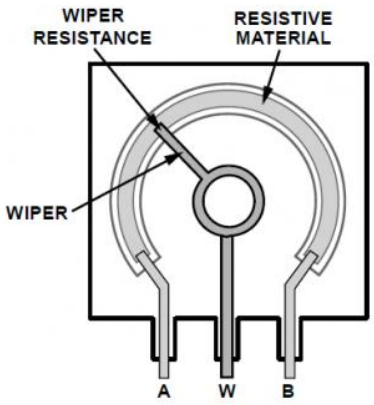
A.1 – Analogic Input

The analogic input on CN2 can be used for different funcation. One of which is to be a torque or velocity setpoint for the DBS drive to follow in busless command.

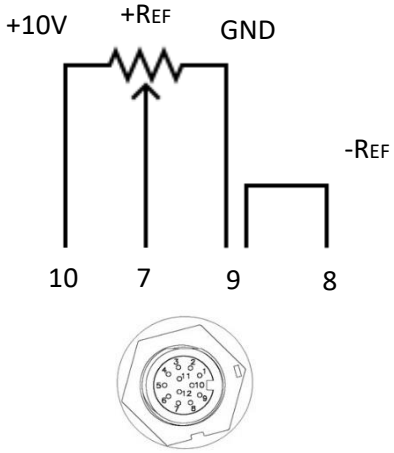
The input configuration must be selected with the P034 parameters from BSI software. Remember that the current analog input requires a hardware modification, so it must be specified in the motor order. Default behavior is 0÷10V.

A.1.1 0÷10V Wiring

A typical use of the 0÷10V input is the three way potentiometer, like the one displayed in the below picture.

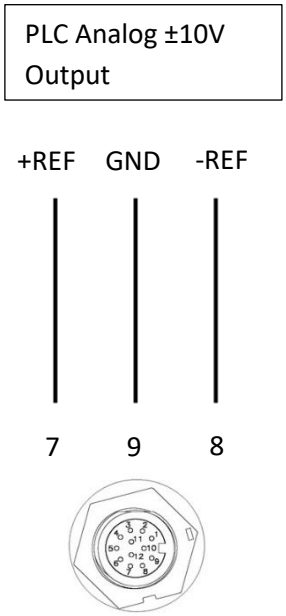


A-B circuit must be connected to digital inputs 10 and 9, the 10V reference and ground respectively. The command signal W must be connected to digital input 7. Considering that the DBS has a differential input, to make it work you must connect digital input 8 with 9.



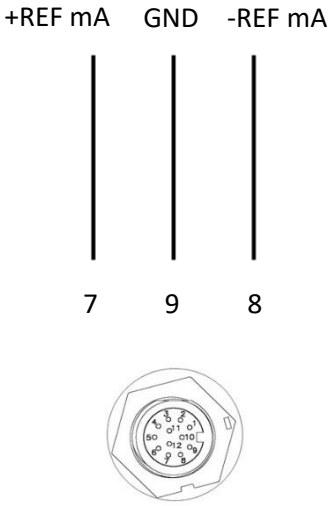
A.1.2 Collegamento -10V÷+10V

A command between -10 V and + 10V is typical of PLC output. It's useful when commanding both velocity direction without a direction command.



A.1.2 Collegamento 4-20mA

The current analogue digital input is motor custom feature to be requested explicitally during the order phase. Parameter P43 will be by default on 3.



APPENDIX B – Fieldbus Examples

The DBS Products supports 6 Fieldbuses: CanOpen, Modbus, Profinet, PowerLink, EthernetIP, and EtherCAT. This makes it usable on a wide ranges of PLCs manufacturers. You can download some application and demo example programs from the following links:

- Profinet: Tia Portal 14 – CPU1215 , Tia V16
- Powerlink: Automation Studio - CSP
- EthernetIP: Rockwell
- EtherCAT: Sysmac Studio - Profile, Sysmac Studio - CSP, Twincat 3 – Profile, Twincat 3 – CSP

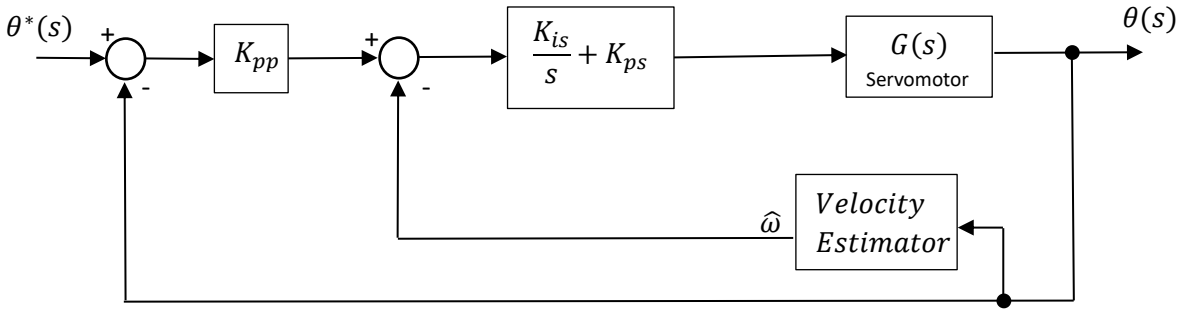
Each example can show the motor work in speed, torque and position profile, together with the homing mode.

You can find the relevant description file in the DeviceDesc folder in our BSI software, which you can download from the product page.

APPENDIX C – PIV gains tuning

Minimotor DBS Servomotor has an internal PIV controller, which can be regolated by the end user. This tuning can be done with our BSI software, changing parameters P237, P238, P253. Using the fieldbus uoi can access the same parameters using the acyclic communication or SDO, at the 20EDh,20EEh, 20FDh addresses.

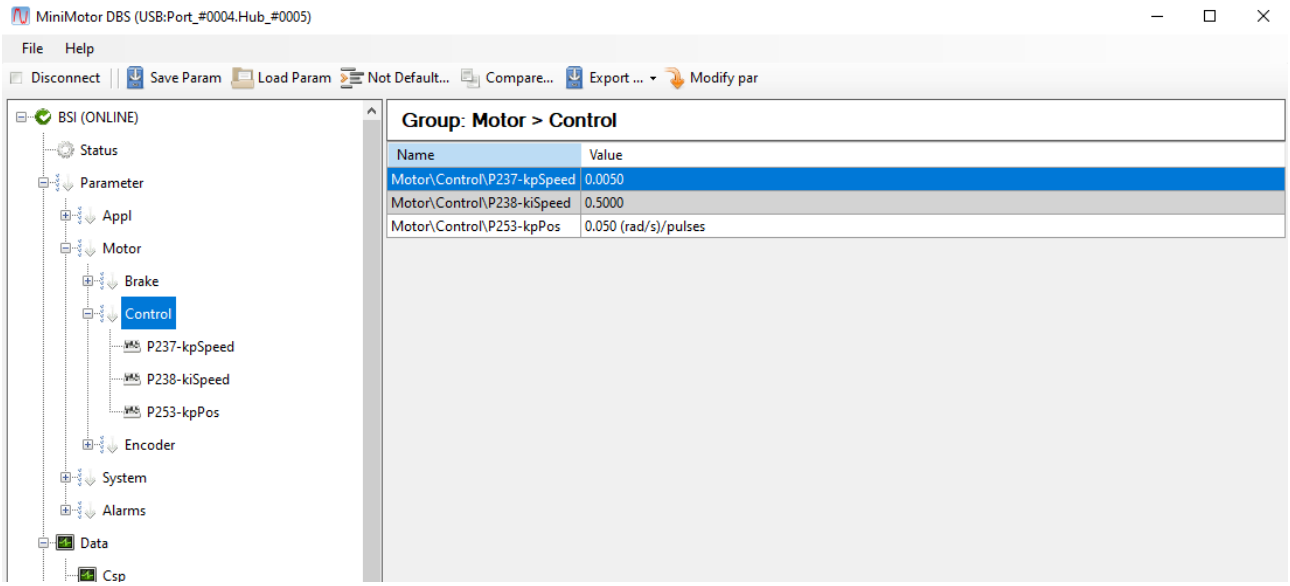
The simplified DBS control loop is the following.



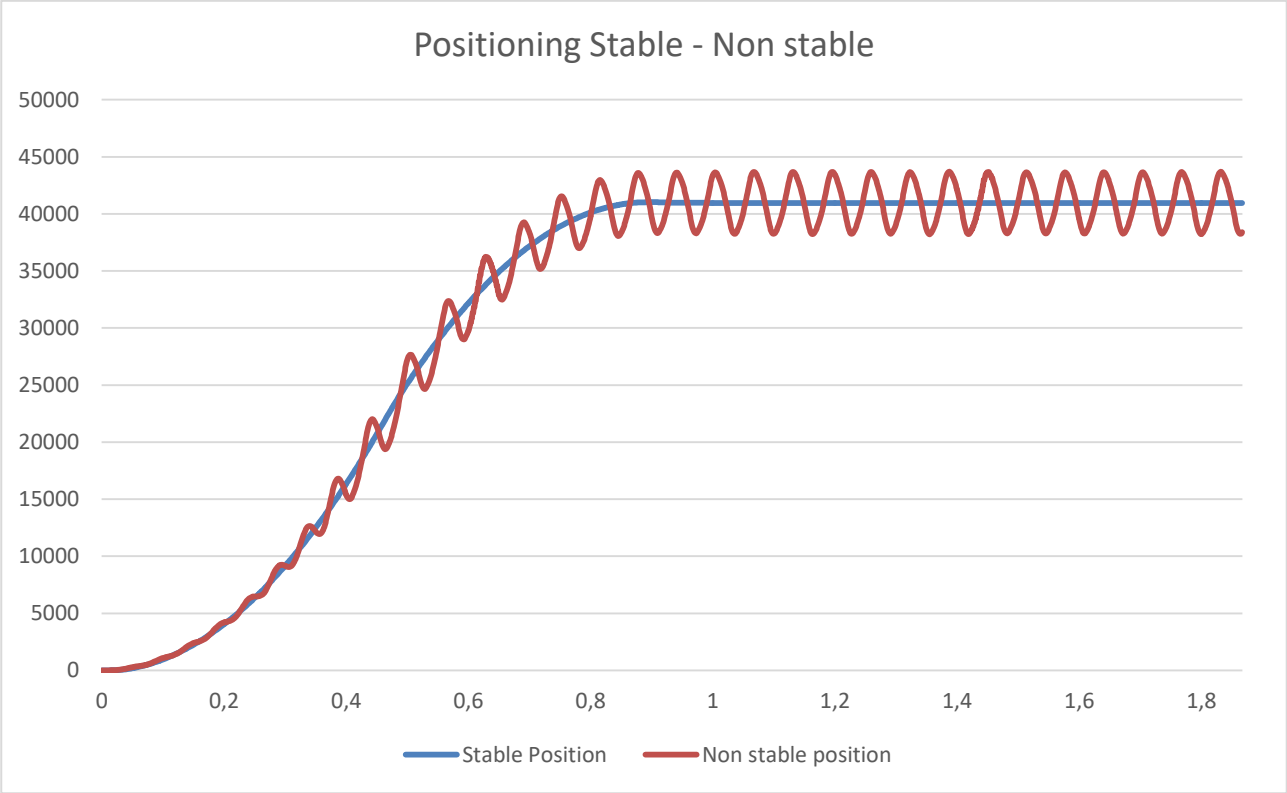
The position setpoit gets multiplied by the gain K_{pp} which turns it to a velocity command. This is in turn elaborated by the velocity proportional gain and integral gain. The encoder position feedback is derivated into an actual velocity estimation and used to drive the velocity loop.

The intensity of the control action depends on the value of P237, P238, P253, K_{ps}, K_{is}, K_{pp} respectively.

The difference between the commanded setpoint and the actual value is called error. Proportional effects create a control action directly proportional to the error. These values are also directly linked to the system stiffness. Integral gains on the other hand accumulate the error over time and they apply a control action to make the system reach 0 error at the steady state.



DBS default values are fine for most applications, but in some cases some manual tuning is required.



Instability can lead to strong oscillations, which can cause non controllable motion from the machine. In other cases you can have weaker performance than expected if the system is not properly tuned.

If your application needs to regulate the values, there are some guidelines to follow.

Thanks to our BSI software you can track all the relevant values needed for the accurate parameter tuning. Check section 3.2.4 of this manual to see how to use BSI to track the motor variables over time.

The first step is the tuning of the inner velocity loop.

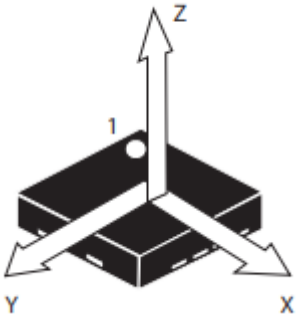
- Set the motor in velocity profile and track the motor speed.
- Increase the proportional speed gain K_{ps}until limit from which there is overshoot.
- Then increase K_{is}until there is a slight overshoot, about 5-10% of the target objective.

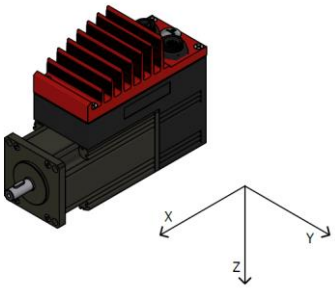
After this it's time to tune the outer position loop

- Set the servomotor in profile position with high acceleration and deceleration and bout half of the desired speed.
- Start from low values of K_{pp} until reaching the overshoot limit.
- Increase the speed to the desired speed and check if everytings works correctly.

The control system can be bandwidth starved in some application. To increase it, decrease the P252 parameter, the speed filter time costant. This will increase bandwith and by tuning the gain properly it enables the desired behaviour to be reached over more demanding applications.

APPENDIX D – Accelerometer





The DBS product family has an 3-axis MEMS accelerometer on board. Its job is to monitor vibrations on the servomotor. This monitoring enables the possibility of predictive maintenance on the servomotor and the machine intself.

Its main technical characteristics are:

- ±2g/±4g/±8g full-scale
- 16-bit data output
- 10 – 800 Hz sampling rate
- RMS output

Go to section 4.1.3 to see which parameters can be set via BSI software and to section 9.3.3 to see the CAN adresses of the accelerometer output variables.

The outputs:

- Instantaneous acceleration [mg]
- DC acceleration [mg][fieldbus]
- RMS acceleration [mg][fieldbus]

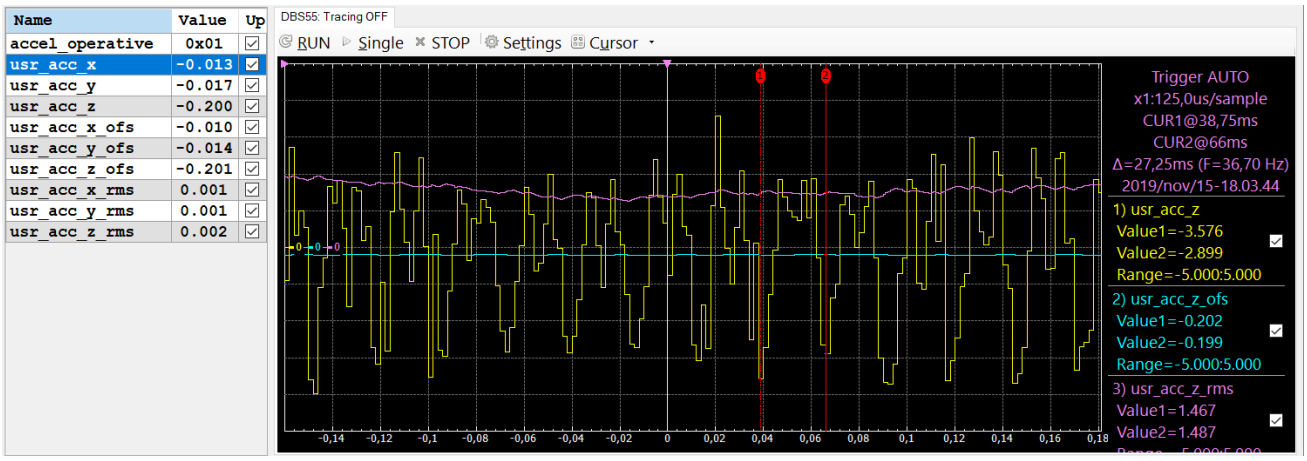
Istantaneous acceleration measures the acceleration on the x,y and z axis. DC acceleration is the static components of the acceleration that can be used to extimate weight vectors.

At each start up the servomotors recalculates the DC offsets to eliminate gravity influence from the istantaneous measurements.

RMS acceleration extracts the sinusoidal part from the vibration and mu be set up to be calculated correctly.

RMS filter setting

- Use the Accel workspace and set up a trace of your vibration.
- Set up the dual cursor and find two peaks.
- Read the time between the two picks
- Pick this value, multiply it by 3-5 and write it in the P037 parameter Rms Tau



General knowledge on Vibrations

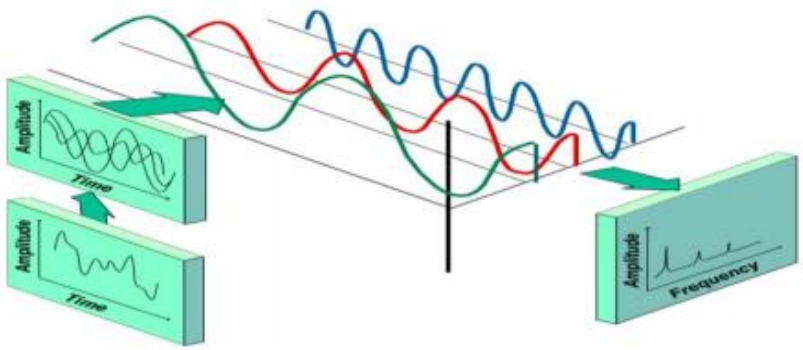
The DBS family accelerometer output data is in the time domain. You can derive different characteristics from it.

- **Peak-to-peak**: it indicates the wave maximum excursion, connected to the severity of the mechanical stress or the mechanical backlash.
- **Peak:** maximum positive or negative range of the wave, connected to short shocks.
- **RMS**: Root Mean Square, it indicates the energy of the vibration.

$$RMS = \sqrt{\frac{1}{T}\int_0^T x^2(t)dt}$$

- **Mean value:** Useful to get an impression of the vibration evolution over time, but it's not directly linked to any physical proprieties.
- **Crest factor**: Ratio between Peak and RMS value. High crest factors identify impulsive phenomenon.

An important step in the vibration analysis is going from the time domain to the frequency domain. To do this one needs to calculate the spectrum of the vibration wave, using the Fourier transform using calculus programs.



With the analisys in the frequency domain it's possible to extract the single contribution of the vibration wave.

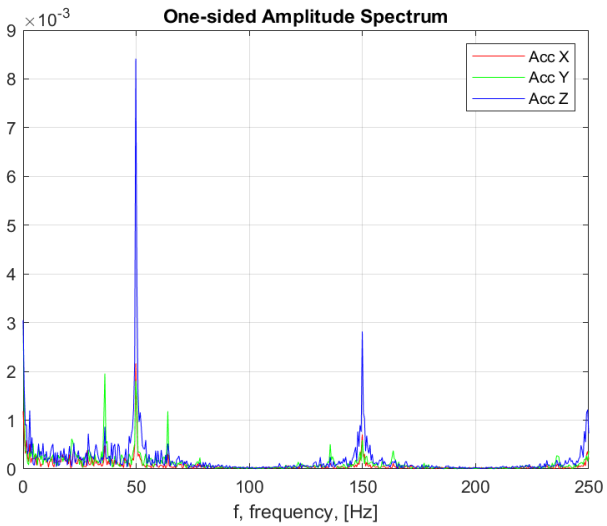


Figure 1 - DBS at 3000 rpm (50 hz)

The analysis of the vibration spectrum is complex and different from application to application. It's outside the scope of this manual to give a complete guide on how to analyze the vibration spectrum.

⚠ Sampling

The most important element to have a good data acquisition is to corretlcy choose the data sampling rate. Parameter P036 determines the accelerometer sampling time. You can choose between these values:

- 10Hz – 100ms
- 50Hz – 20ms
- 100Hz – 10ms
- 200Hz – 5ms
- 400Hz – 2,5ms
- 800Hz – 1,25ms

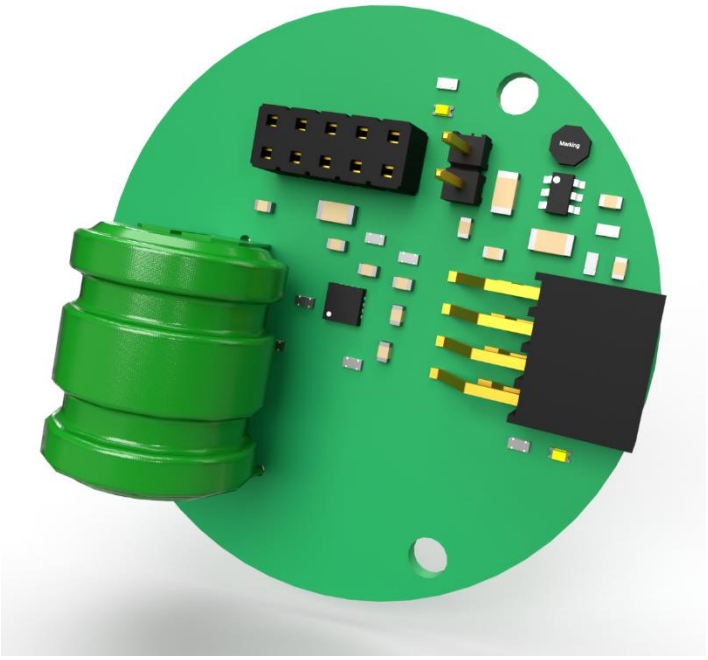
Selecting the latter two vales of 400Hz and 800Hz can incour in Aliasing. Aliasing is a phenomenon that can make indistinguishable two different analog signals due to sampling issues. This is due to the undersampling that occurs between the microcontroller and the accelerometer.

Another factor to consider is how one can only detect analog signals at half the frequency of the sampling frequency. So selecting 200Hz of sampling frequency is useful to intercept signals up to 100Hz.

At the same time the difference in sampling time and PLC cycle time is important to correctly sample the vibration data. Fore example, choosing to sample the accelerometer at 400Hz, so once every 2,2ms, and transfer data to the PLC every 4ms, will incur in subsampling aliasing.

That's why the most universally useful data to acquire at runtime in the process data is the RMS value, which can be collected in EtherNet IP and Profinet process data. In EtherCAT and Powerlink you can select which object to map, depending on your network performance.

APPENDIX E – Encoder Battery Managment



The DBS systems has an absolute multiturn encoder, with a 4096 pulses single turn resolution for a total 32bit multi-turn resolution.

The Absolute part enables the motor to remember its position even if powered off, and even if it's moved while in such state. To do so, the magnetic encoder circuit must must be powered. The solution adopted by Minimotor is an integrated rechargeable battery.

Before delivery, the product is subject to a full charge. As we say in section 1.5 of this manual, we advise at the first start up of the motor, or after 2 months of powered off have passed, to keep the motor plugged in for at least 24 hours. The battery is recharged with the logic power (see sections 2.4 and 2.5 for the electrical connections)

E.1 – Battery Managment in Storage

As said in section 1.6, every 6 months of non-use the battery (i.e. the DBS servomotor) should receive a full charge to guarantee performance and health. For the complete charge, you must have the motor plugged in the logic power for at least 24 hours.

E.2 – Battery Managment in Software

In normal working conditions, the presence of the battery is invisible to the system. One pluggen in, the battery stays top-filled and the motor will work with grid power.

If conditions arise for the battery to disrcharge until empty, let's imagine a more than 2 months long ship trip, or the motori s stocked in a wharehouse for more than 2 months, the motor will be in fault condition.

Status Word bid 3 will have a high logic value and register 3008h, the Actual Alarm register, will have a value of 203, which is the PMSM_ENCSPI_MT erro, according to section 6 of this manual. Using the fault reset prodecure, using the Bit 7 of the Control Word, the error can be reset.

After an error 203, the Multiturn position is no longer reliable and **the position must be homed again**. Register 3008h is already avalaible in the PDO of Profinet and Ethernet IP, and can be freely accessible in CanOpen, EtherCAT and Powerlink, with the possibility to be mapped to the PDO.

Our advice is having a routine in place that checks the error number of the motor. If the error 203 is detected, the system should tell the operator to perform a realignment of the motor before continuing.

Appendice F – Pre-Wired Cables

One of the DBS accessories are pre-wired cables. For avalaibility, minimum quantity, delivery times and lengths avalaible, check the DBS configurator or contact Mini Motor.

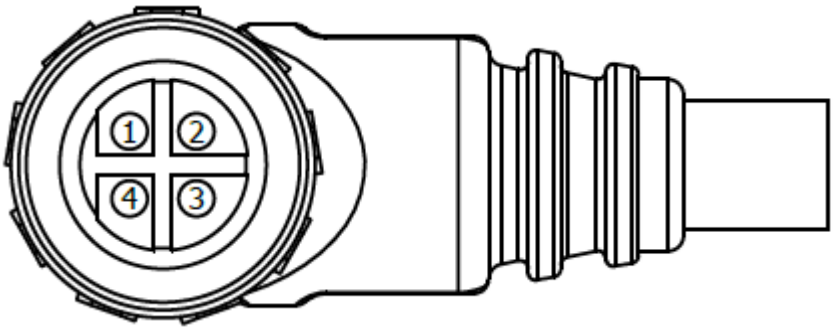
The avalaible codes are the following:

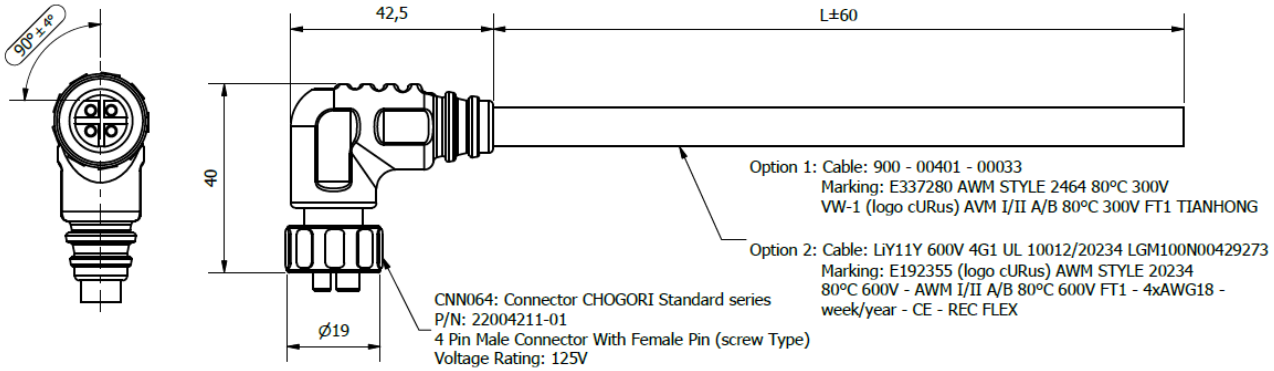
Product Code	Installation	Angle	Function
CBL023	Fixed	90°	CN1 DBS55
CBL024	Fixed	90°	CN2
CBL031	Mobile	90°	CN1 DBS55
CBL032	Mobile	90°	CN2
CBL033	Fixed	Straight	CN1 DBS55
CBL034	Fixed	Straight	CN2
CBL035	Mobile	Straight	CN1 DBS55
CBL036	Mobile	Straight	CN2
CBL037	Fixed	Straight	CN1 DBS 80
CBL038	Mobile	Straight	CN1 DBS 80

The connection schemes are the following:
(Note, Logica is Logic, Potenza is Power)

F.1 - CBL023

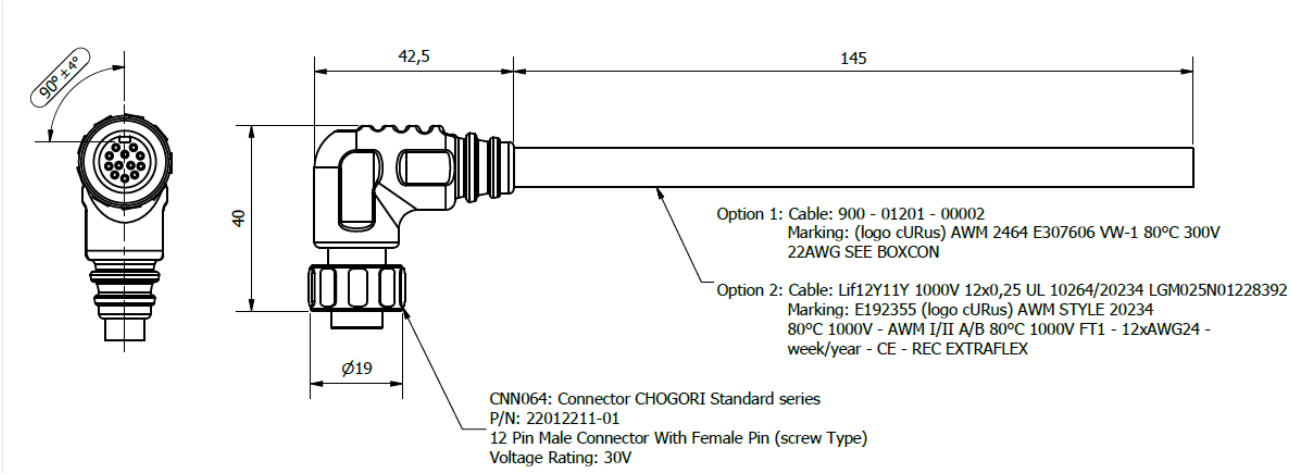
Pin Assignments Front View			
Conn	Mode	Wire Color Option 1	Wire Color Option 2
4	+ Logica	Brown	Brown
3	+ Potenza	Red	Gray
2	- Potenza	Black	Black
1	- Logica	Blue	Blue





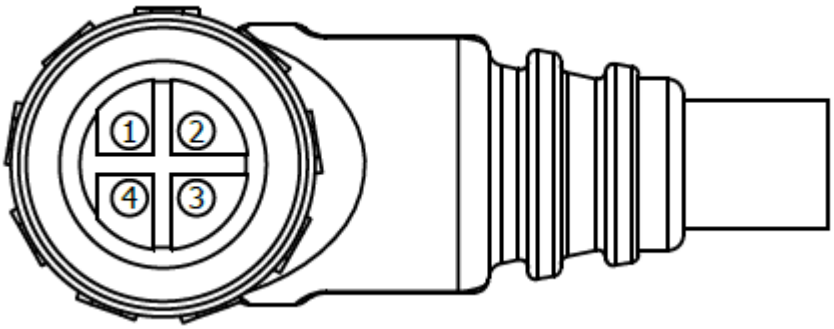
F.2 - CBL024

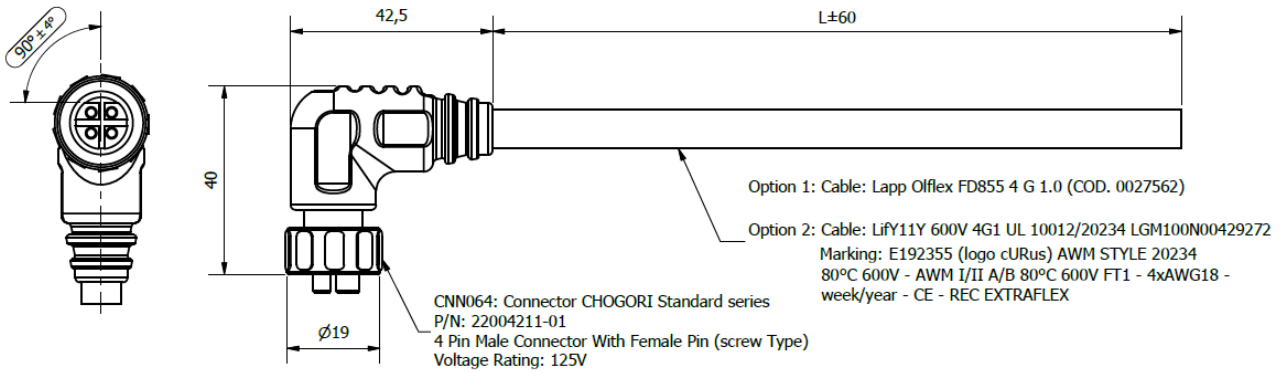
Pin Assignments Front View		
PIN	Wire Color Option 1	Wire Color Option 2
1	Black	Black
2	Brown	Brown
3	Red	Red
4	Orange	Gray/Pink
5	Yellow	Yellow
6	Green	Green
7	Blue	Blue
8	Purple	Purple
9	Grey	Grey
10	White	White
11	Pink	Pink
12	Light green	Red/Blue



F.3 - CBL031

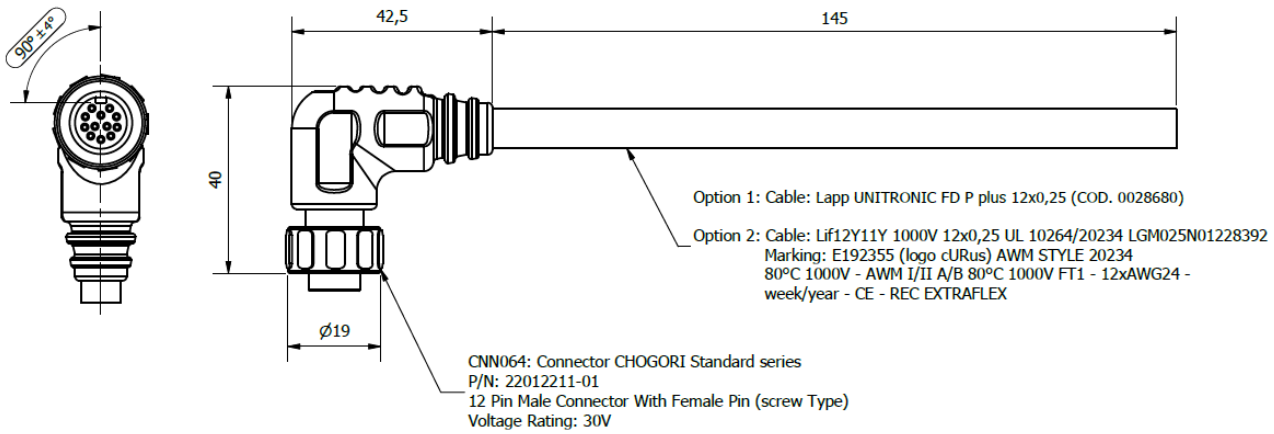
Pin Assignments Front View			
Conn	Mode	Wire Color Option 1	Wire Color Option 2
4	+ Logica	3	Brown
3	+ Potenza	2	Gray
2	- Potenza	1	Black
1	- Logica	Yellow/Green	Blue





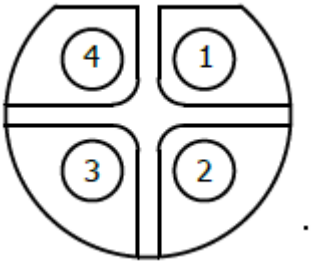
F.4 - CBL032

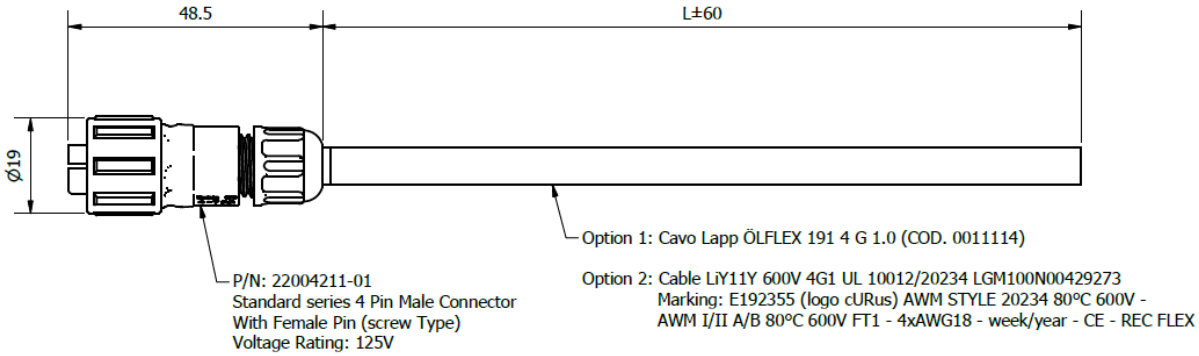
Pin Assignments Front View	
PIN	COLOR
1	Black
2	Brown
3	Red
4	Gray/Pink
5	Yellow
6	Green
7	Blue
8	Violet
9	Grey
10	White
11	Pink
12	Red/Blue



F.5 - CBL033

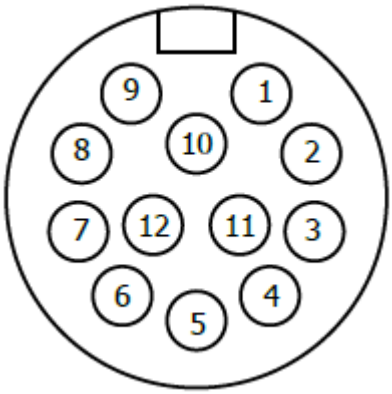
Pin Assignments Front View			
Conn	Mode	Wire Color Option 1	Wire Color Option 2
4	+ Logica	3	Brown
3	+ Potenza	2	Gray
2	- Potenza	1	Black
1	- Logica	Yellow/Green	Blue

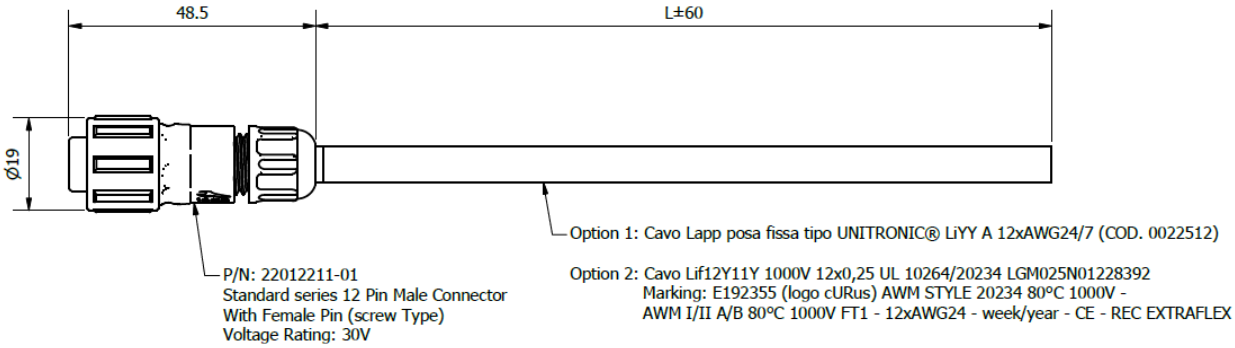




F.6 - CBL034

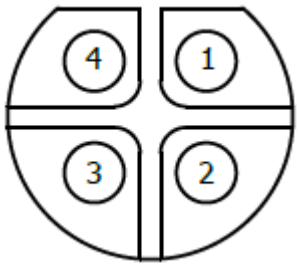
Pin Assignments Front View	
PIN	COLOR
1	Black
2	Brown
3	Red
4	Gray/Pink
5	Yellow
6	Green
7	Blue
8	Violet
9	Grey
10	White
11	Pink
12	Red/Blue

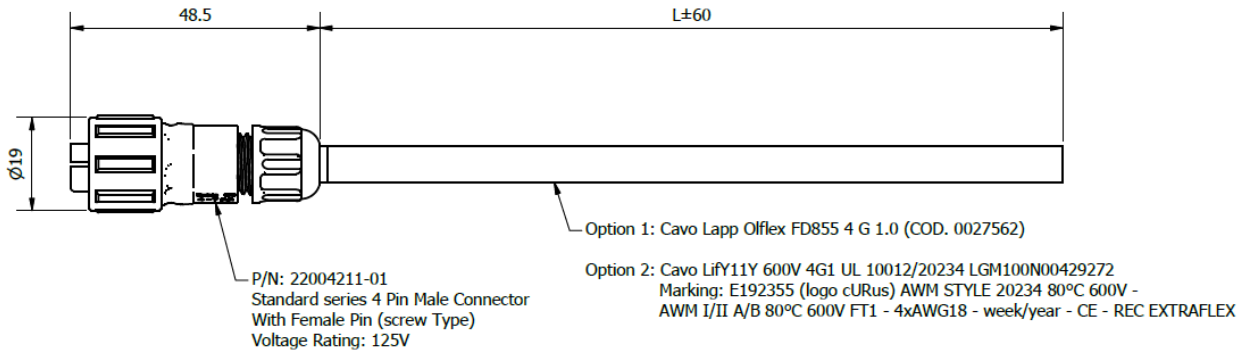




F.7 - CBL035

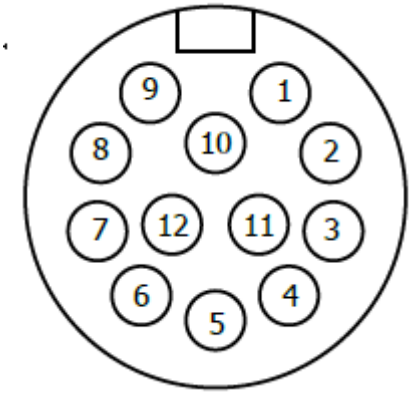
Pin Assignments Front View		
Conn	Wire Color	Mode
4	3	+ Logica
3	2	+ Potenza
2	1	- Potenza
1	Yellow/Green	- Logica

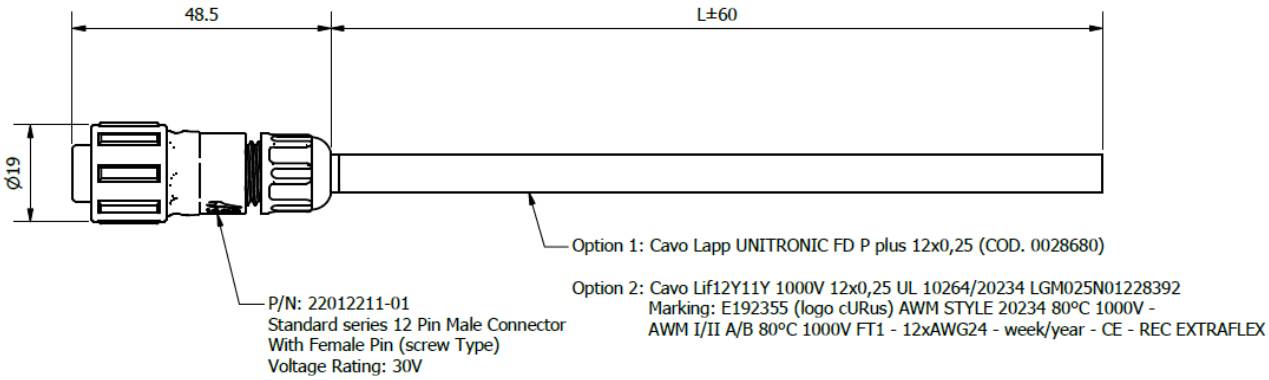




F.8 - CBL036

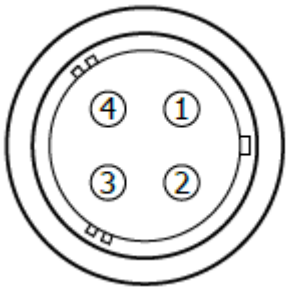
Pin Assignments Front View	
PIN	COLOR
1	Black
2	Brown
3	Red
4	Grey/Pink
5	Yellow
6	Green
7	Blue
8	Violet
9	Grey
10	White
11	Pink
12	Red/Blue

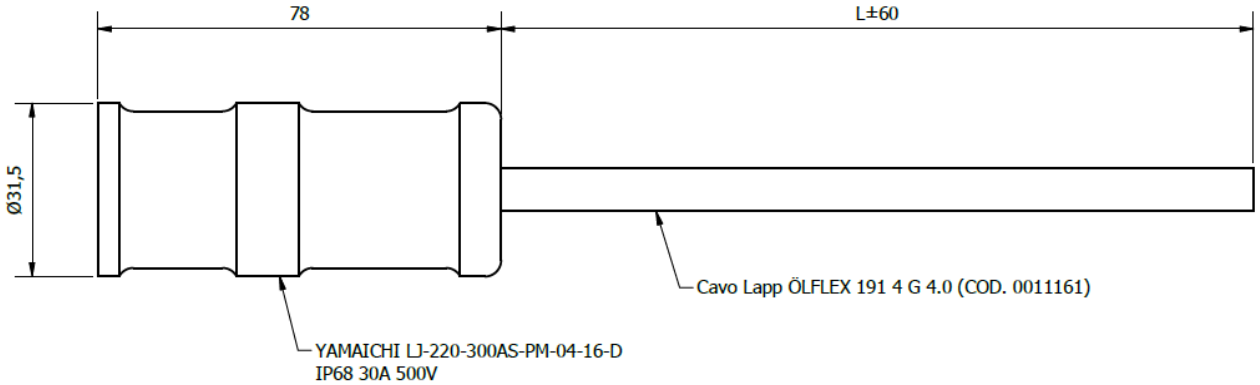




F.9 - CBL037

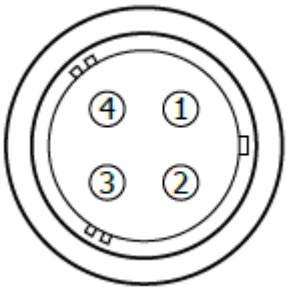
Pin Assignments Front View		
Conn	Wire Color	Mode
4	3	+ Logica
3	2	- Potenza
2	1	+ Potenza
1	Yellow/Green	- Logica

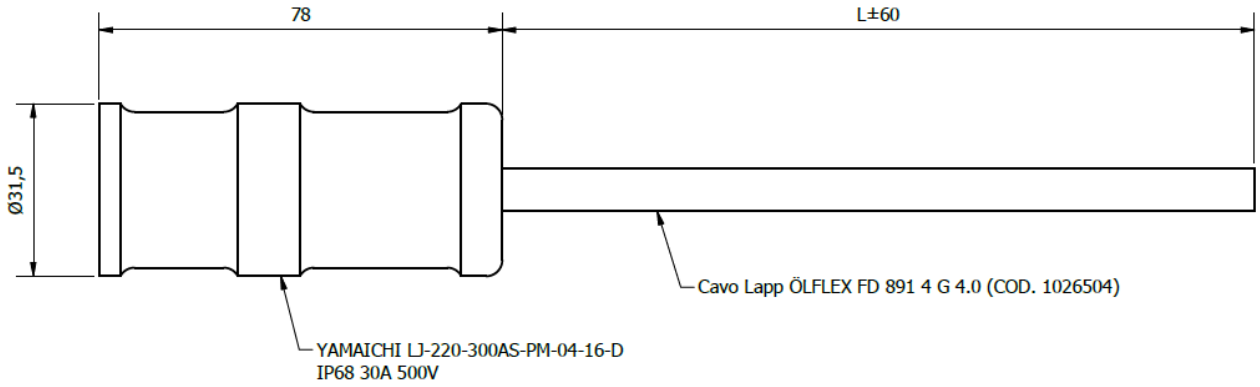




F.10 - CBL038

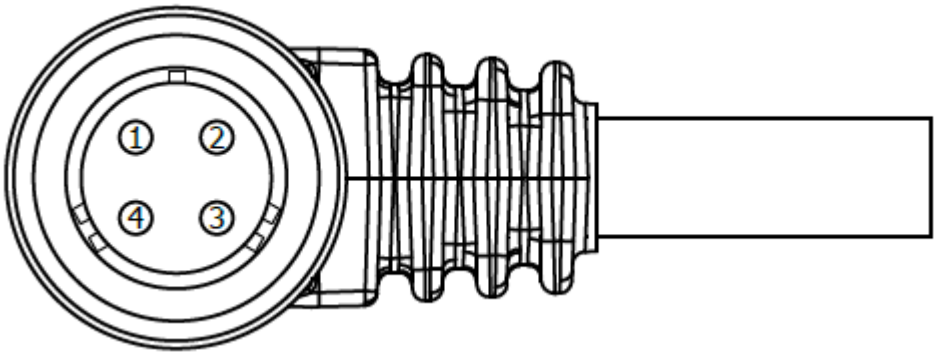
Pin Assignments Front View			
Conn	Mode	Wire Color Option 1	Wire Color Option 2
4	+ Logica	3	Brown
3	- Potenza	2	Black
2	+ Potenza	1	Gray
1	- Logica	Yellow/Green	Blue

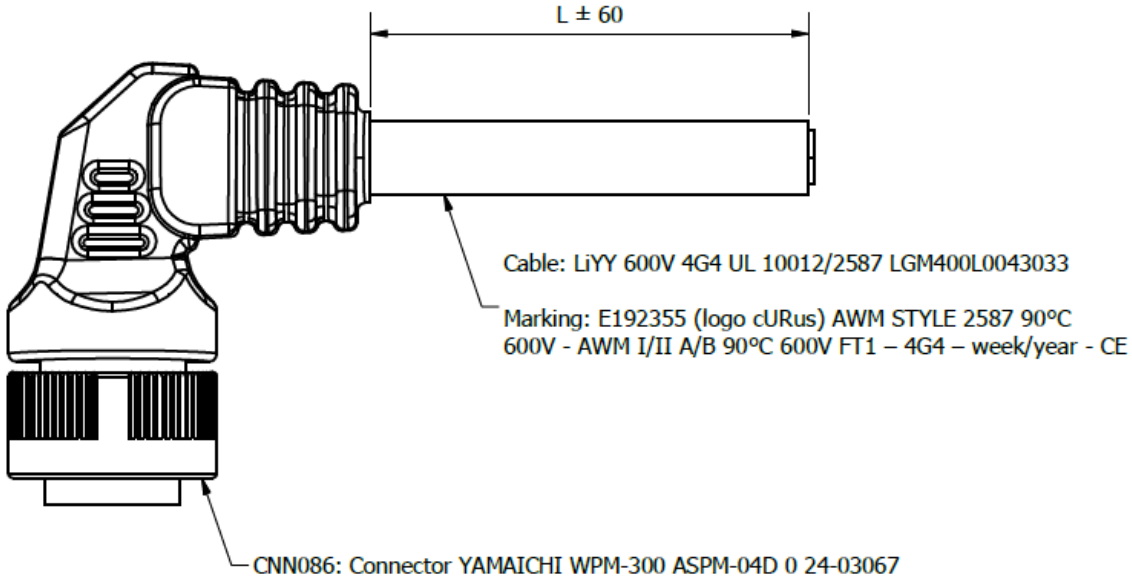




F.11 - CBL039

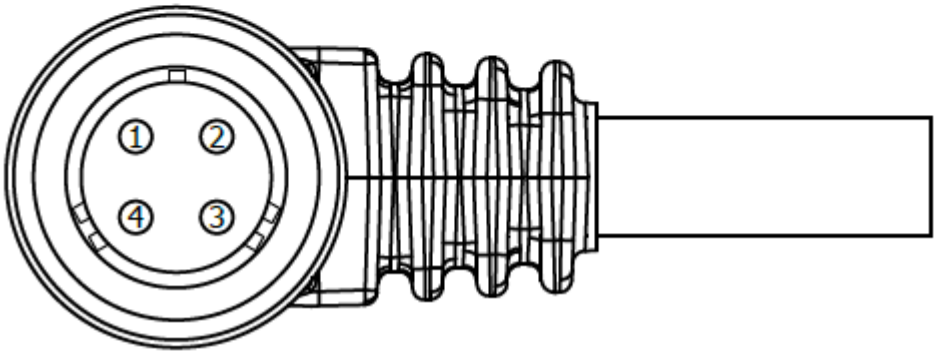
Pin Assignments Front View		
Conn	Wire Color	Mode
4	Brown	+ Logica
3	Black	- Potenza
2	Gray	+ Potenza
1	Blue	- Logica

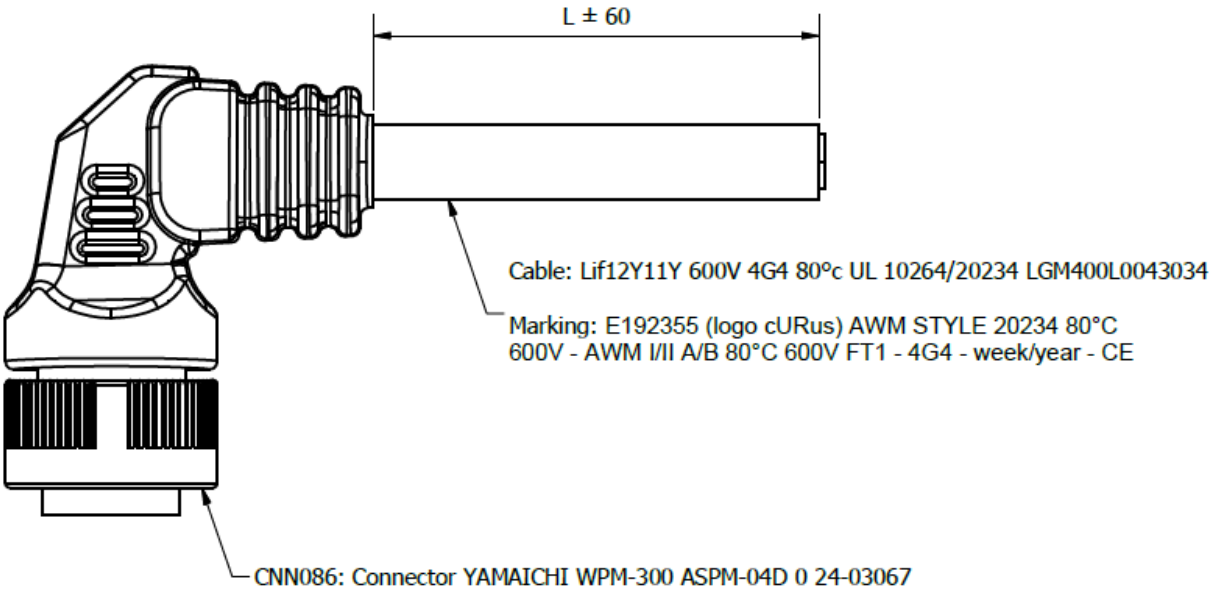




F.12 - CBL040

Pin Assignments Front View		
Conn	Wire Color	Mode
4	Brown	+ Logica
3	Black	- Potenza
2	Gray	+ Potenza
1	Blue	- Logica



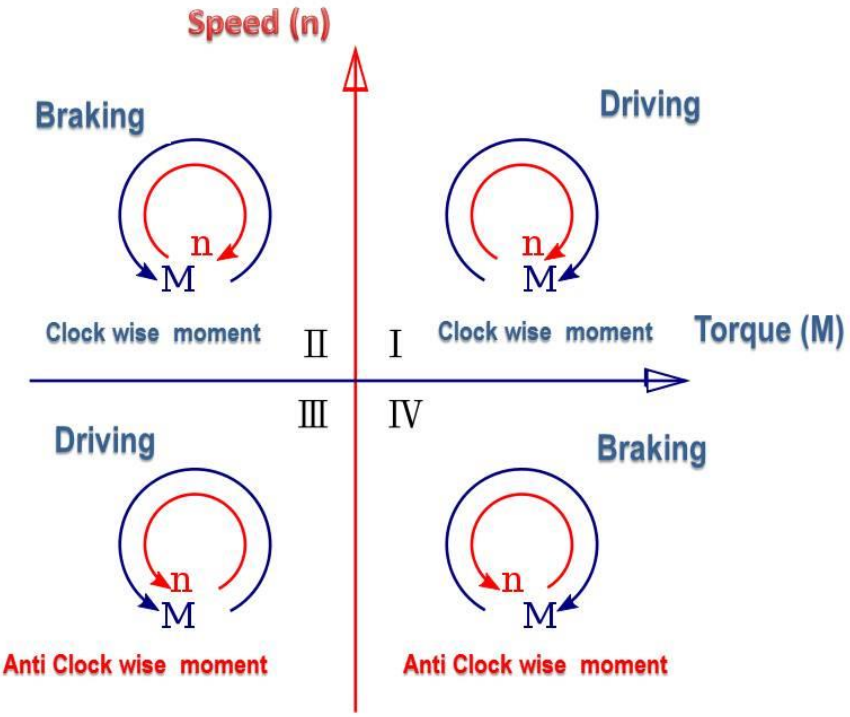


Appendix G – Braking Resistor

An electric motor is a bidirectional machine. It is capable of both converting electrical energy into kinetic energy and the opposite.

The conversion of kinetic energy to electrical energy occurs when the system applies a torque of opposite direction to the direction of rotation of the shaft.

The electrical energy thus produced, must flow within the circuit ending up on a load.



In DBS systems, being low voltage and generally fed by individual power supplies, this energy is stored on the DC BUS, specifically on the grid capacitances. If the energy to be stored is greater than the absorption capacity of the DC bus, its voltage will increase until the component most sensitive to this surge signals a problem.

The DBS system has an overvoltage threshold of **55 volts**.

Bit 3 of the Status Word will go to value 1 and register 3008, the Actual Alarm, will indicate code 3 OVERVOLT, according to the coding in paragraph 6.

This error is resettable by the user by bringing bit 7 of the Control Word to a logical high value.

Should this behavior occur constantly during normal machine cycling, it will be necessary to **equip the system with components capable of handling the regeneration energy flow.**

The two possible technical solutions are:

- Capacitors
- Braking resistor

The first have the task of absorbing kinetic energy within the circuit and making it available for later use, acting as batteries. The second has the job of dissipating excess power into heat.

Assuming the classic work cycle consisting of acceleration, constant speed operation and deceleration, we must focus attention on the deceleration phase.

Calculation of Kinetic Energy to Dissipate:

$$E_k = \frac{1}{2}(J_m + J_l) \cdot \left(2\pi \cdot \frac{N}{60}\right)^2$$

With J_m the motor inertia, J_l the load inertia, and *N* the number of motor revolutions in rpm.

Knowing the deceleration time $T_{dec}$from our cycle, it is easy to calculate the power to be dissipated in braking.

$$P_{dec} = \frac{E_k}{T_{dec}}$$

To size capacitors to store braking energy, the formula to follow is as follows:

$$E_{DC} = \frac{1}{2}C(V_h^2 - V_l^2)$$

With *C* the capacitance of the capacitors, $V_h$the maximum value that can be reached by the power supply or motor before reporting an overvoltage alarm, and V_l the rated bus voltage.

SCH 108 – 109 - 110

Our range of accessories for the DBS line includes a braking resistor in two versions

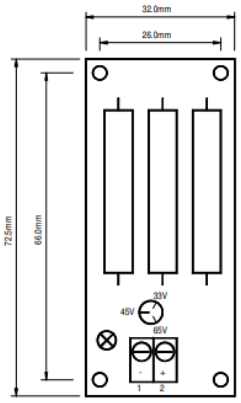
SCH 108 operating for 24VDC supply motors.

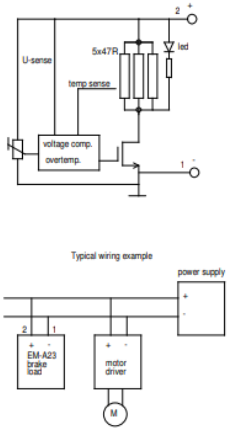
SCH 109 for motors with 48VDC supply at low power

SCH110 for motors with 48VDC supply at high power

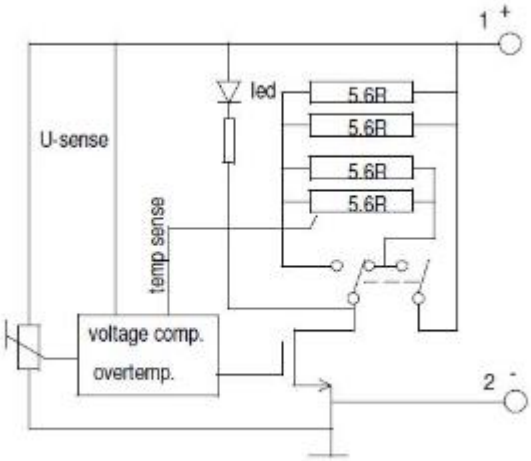
These boards allow setting the trip threshold at which they activate. When the voltage reaches the set threshold they go into action, dissipating excess energy on the resistor. The board provides built-in temperature protection.


7@15R 10W
7@15R 10W
7@15R 10W


32.0mm
26.0mm
72.5mm
66.0mm
33V
45V
65V
1
2


2 +
U-sense
5x47R
led
temp sense
voltage comp.
overtemp.
1 -
Typical wiring example
power supply
EM-A23
brake
load
motor
driver
M


OMC CHINA
TUW15J5R6
OMC CHINA
TUW15J5R6
OMC CHINA
TUW15J5R6
OMC CHINA
TUW15J5R6
EM-A43 v3
+ 1 2 -


1 +
led
5.6R
5.6R
5.6R
5.6R
U-sense
temp sense
voltage comp.
overtemp.
2 -

Mini Motor S.p.a.

Via E.Fermi, 5

42011 Bagnolo in Piano (RE), Italy

Tel. +39 0522 951889

Fax. +39 0522 952610

info@minimotor.com

www.minimotor.com