MOOG

Application Note:

Wiring Diagrams to replace DS2000 with DS2020

L-ANS1-E-171

Foreword

Moog has identified the DS2020 as the ideal replacement for the DS2000 drive in all applications. In the following pages the main characteristics of the two drives are listed and the necessary operations to make the replacement while maintaining the functionality of the system, are detailed.

Index

DS2000	**pg**	**2**
Dimensions		
Standard sizes		
Connection and Connectors		
DS2020	**pg**	**7**
Dimensions		
Standard sizes		
Connection and Connectors		
Size comparison	**pg**	**12**
Preliminary operations details	**pg**	**12**
DS2000 Interface towards DS2020	**pg**	**13**
DS2020 settings	**pg**	**16**
Operational Addendum	**pg**	**17**

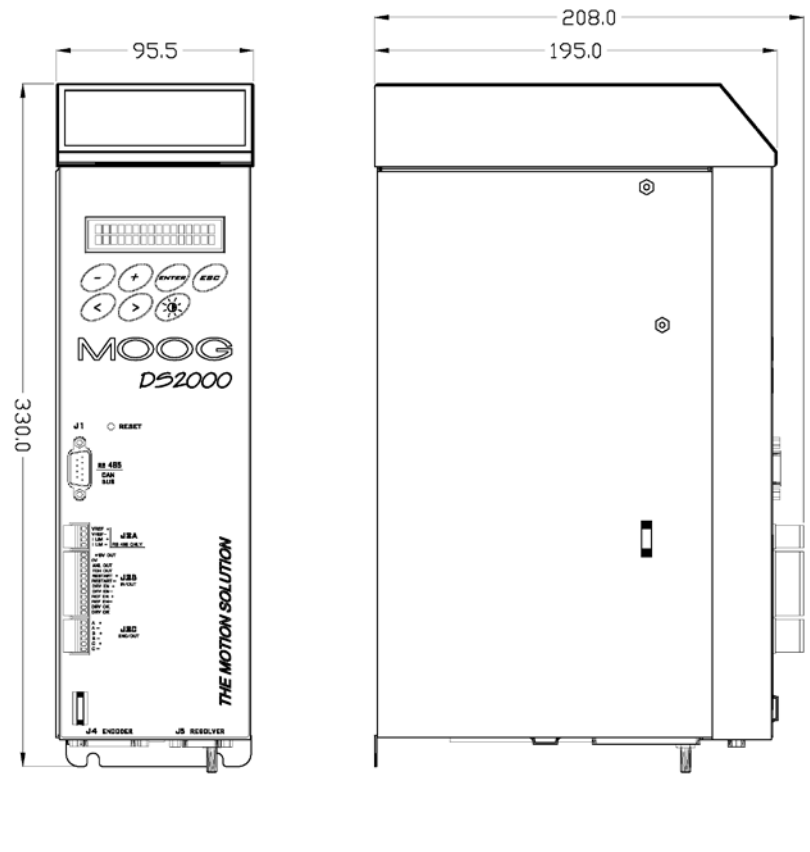
DS2000

The DS2000 is a fully digital drive, powered by 220 to 460 Vac three-phase, equipped with soft start and braking units on all sizes; Is equipped with a on-board programming keypad and an RS485 / 422 interface for interfacing with a computer or PLC.

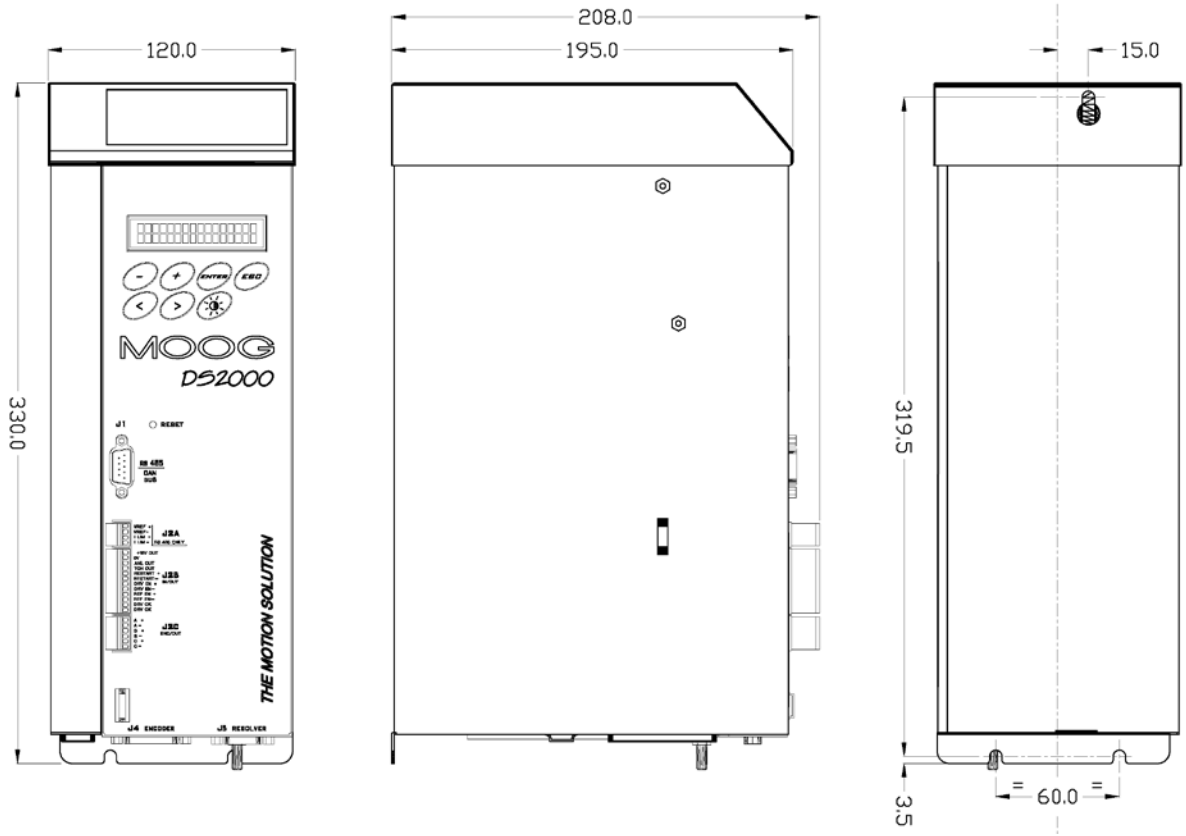
Available sizes cover currents from 3 to 140 Arms, with peak values from 9 to 500 Asin and drives are ventilated independently.

The DS2000 drives allow you to use any type of brushless motor and any type of resolver.

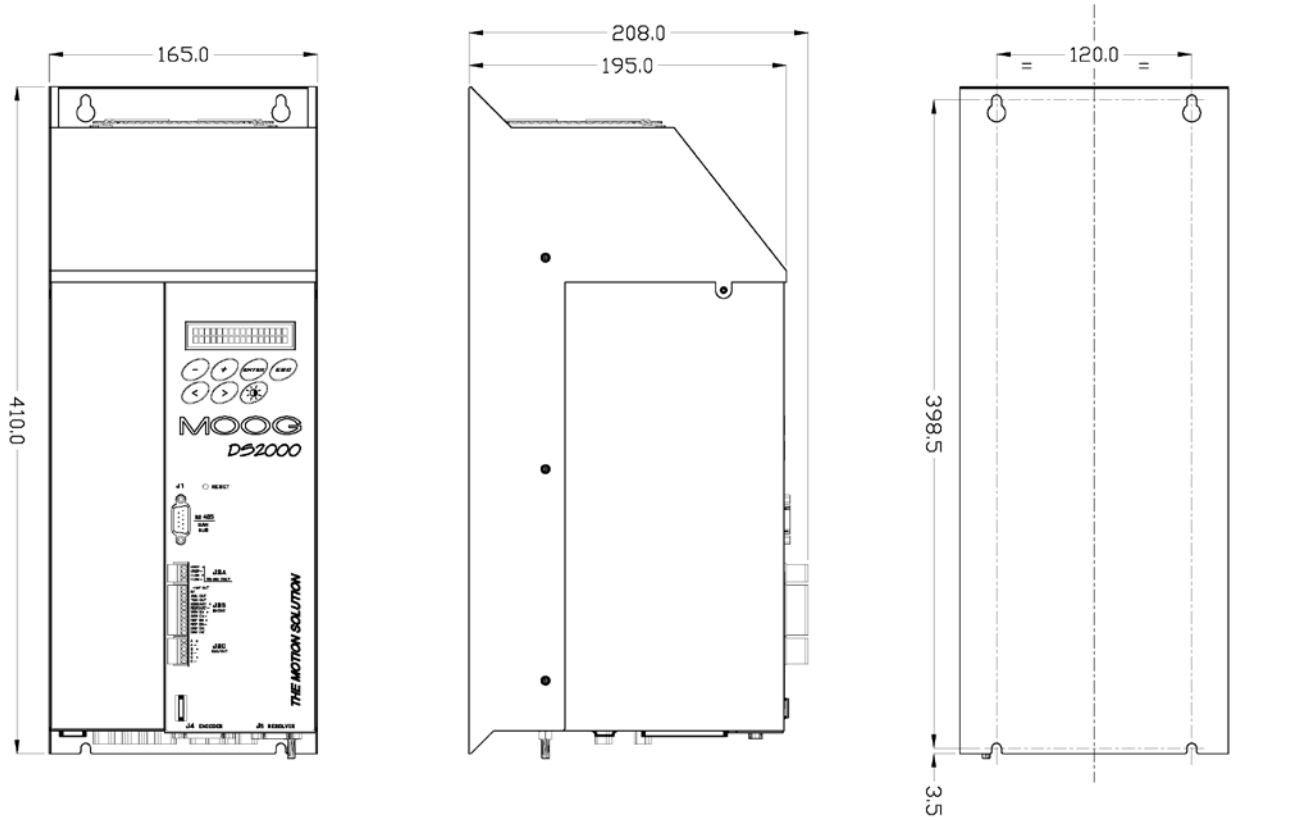
Dimensioni



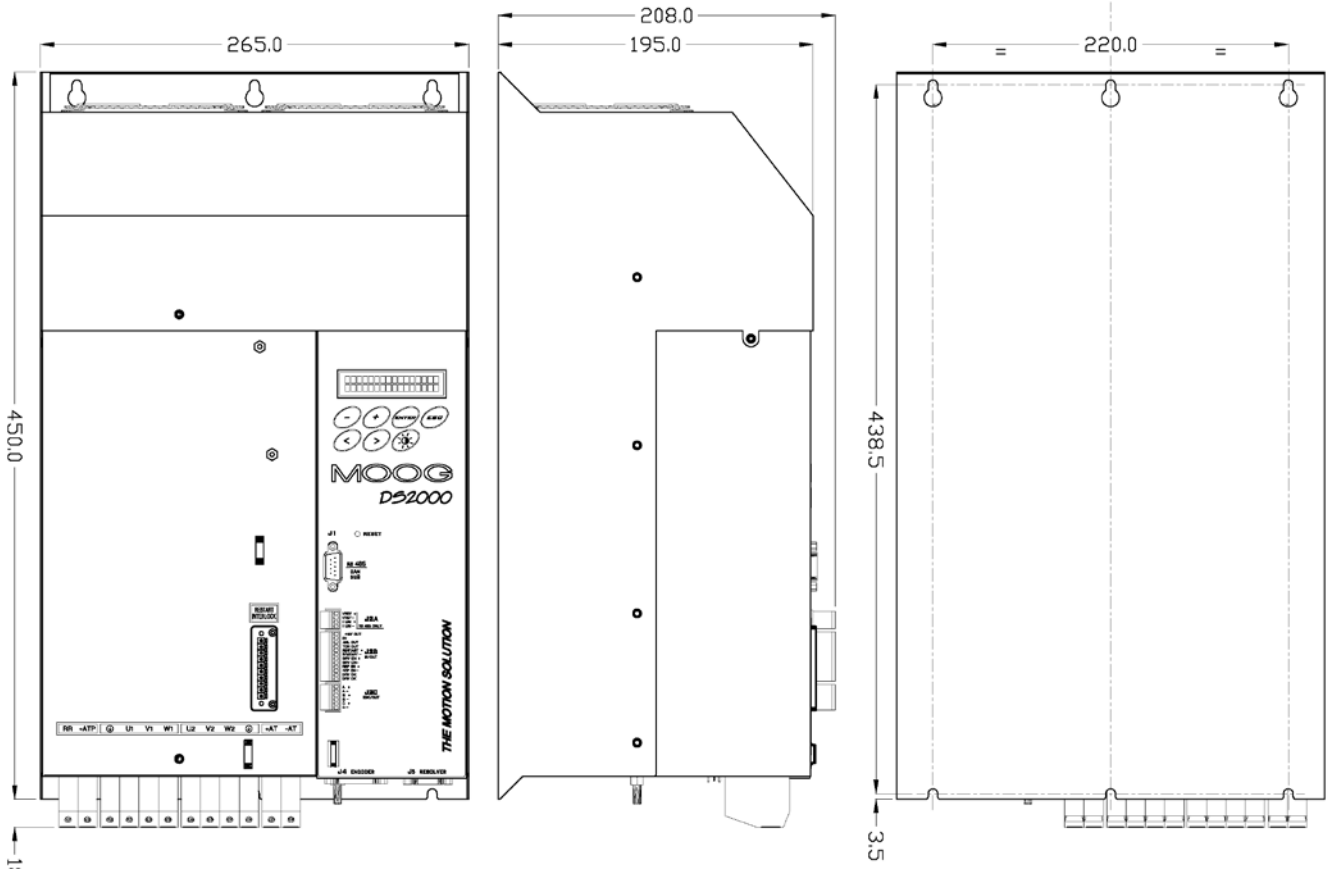
Size A



Size B


165.0
410.0
208.0
195.0
120.0
398.5
3.5
MOOG
DS2000
THE MOTION SOLUTION

Size C


265.0
450.0
208.0
195.0
220.0
438.5
3.5
MOOG
DS2000
THE MOTION SOLUTION

Size D

Available Sizes

Model	Output current			Weight (kg)	Size
	Rated (A_{rms})	Maximum (A_{rms})	Peak (A)		
3/9	3	6.4	9	4.5	A
4/12	4	8.5	12	4.5	A
6/15	6	10.6	15	4.5	A
8/22	8	15.6	22	4.5	A
14/42	14	29.7	42	6	B
20/45	20	31.8	45	10	C
25/70	25	49.5	70	10	C
30/90	30	63.6	90	10	C
50/140	50	99.0	140	23	D

Note:

The first number of the size indicates the RMS output current of the drive; The second number is the peak sinusoidal output current; The RMS peak value is obtained by dividing this value by 0.7. A verification of the codes and models must be made at the time of order in order to have the exact compatibility between the drives.

Attention

The DS2020 currently only covers the DS2000 sizes up to 50/140

Connections

Input References Connector J2A

Pos.	N	Function
1 ■	V_{Ref}+	Differential, non-inverted input of speed or torque reference signal (0÷ ±10V, corresponding to 0÷ ±Max input reference). The end of scale is adjustable via software from ±3.2 to ±10V in steps of 0.1V
2	V_{Ref}-	Differential, inverted input of speed or torque reference signal
3	I_{limit}+	Differential, non-inverted input of analog current limit (0÷ ±10V, corresponding to 0÷ 100%Max set current). The end of scale is adjust-able via software from ±3.2 to ±10V in steps of 0.1V
4	I_{limit}-	Differential, inverted input of analog current limit

Drive Enable Connector J2B

Pos.	N	Function
1 ■	+15V OUT	+15V_{dc} output, max 100 mA
2	0V	Logic Zero
3	ANL OUT	Configurable output (see Analog out configuration)
4	TCH OUT	Tachometric signal output (0 ÷ ±10V, corresponding to 0 ÷ ± Max speed rpm). The end of scale is adjustable via software from ±5 to ±10V in steps of 0.1V
5	ESTART+	Opto-insulated Reset input (15 ÷24 V_{dc}/12mA) By means of a > 20 ms duration pulse the re-initialization of the digital control card and the protections reset are carried out
6	ESTART-	
7	DRV EN+	Opto-insulated Drive Enable input (15 ÷ 24 V_{dc}/12mA) When signal is missing the drive does not supply current
8	DRV EN-	
9	EF EN+	Opto-insulated Reference Enable input (15 ÷ 24 V_{dc}/12mA) When signal is missing the motor is in standstill position, at zero speed if in speed control mode, it has zero torque if in torque control mode. This input can be used for emergency braking
10	EF EN-	
11	RV OK	Drive OK outputs. Contact closed (24V_{dc} relays, max 100 mA) indicates that Drive is OK. *It is recommended to logically connect the DRIVE OK isolated output presence to the power contactor, so that the power supply is disabled in case of fault*
12	RV OK	

Connector Simulated Encoder J2C

Pos.	Name	Function
1 ■	A+	Encoder output: A channel
2	A-	Encoder output: A channel denied
3	B+	Encoder output: B channel
4	B-	Encoder output: B channel denied
5	C+	Encoder output: C channel
6	C-	Encoder output: C channel denied

DS2020

The DS2020 is a series of digital drives that can simply replace the corresponding DS2000 family models.
The available sizes cover currents from 2 to 48 Arms, with peak values from 4 to 96 Arms and the drives are ventilated independently.

The DS2020 drives have the same customizations as DS2000 drives, using any type of motor and any type of resolver; Replacement is always possible as all the same features are available.

Whilst changing the connectors it is possible to control both the drives in the same way and have the same enabling and command sequences.

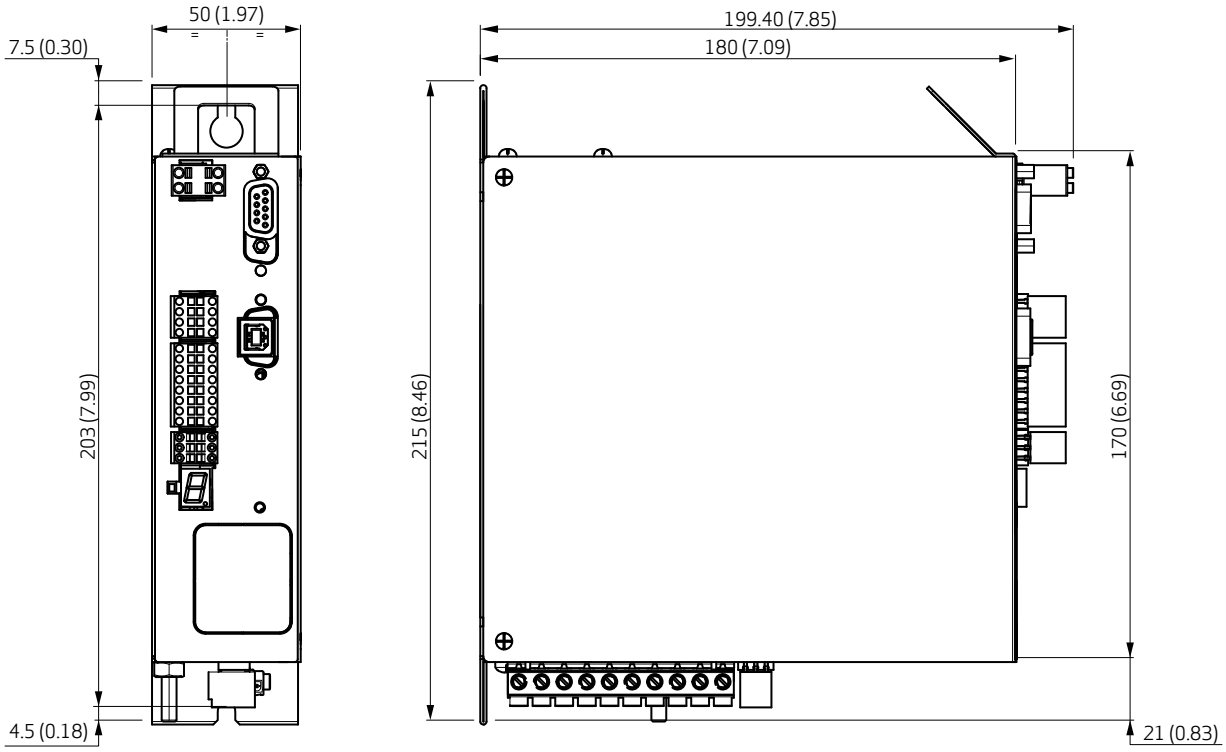
The auxiliary power is 24 Volt DC.

Note:

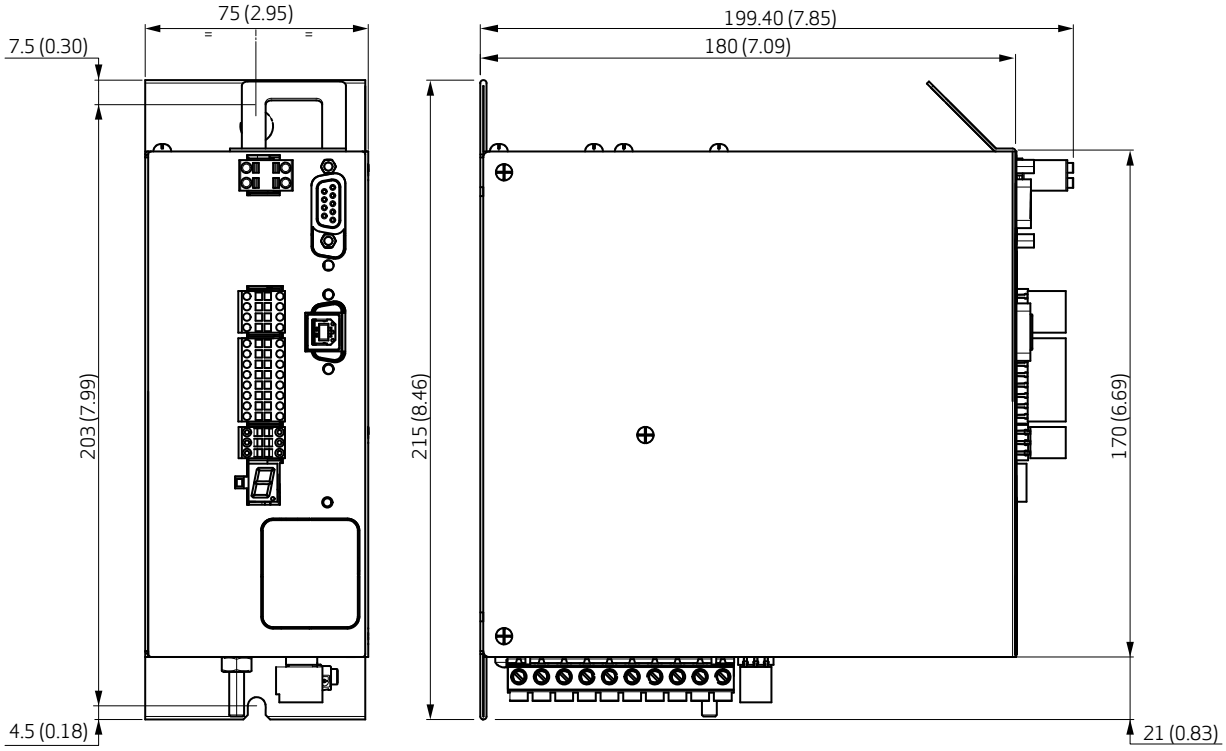
If DS2000 is used with the simulated external encoder in "single ended" mode, contact Moog Casella to check the compatibility between the signal levels.

Dimensions

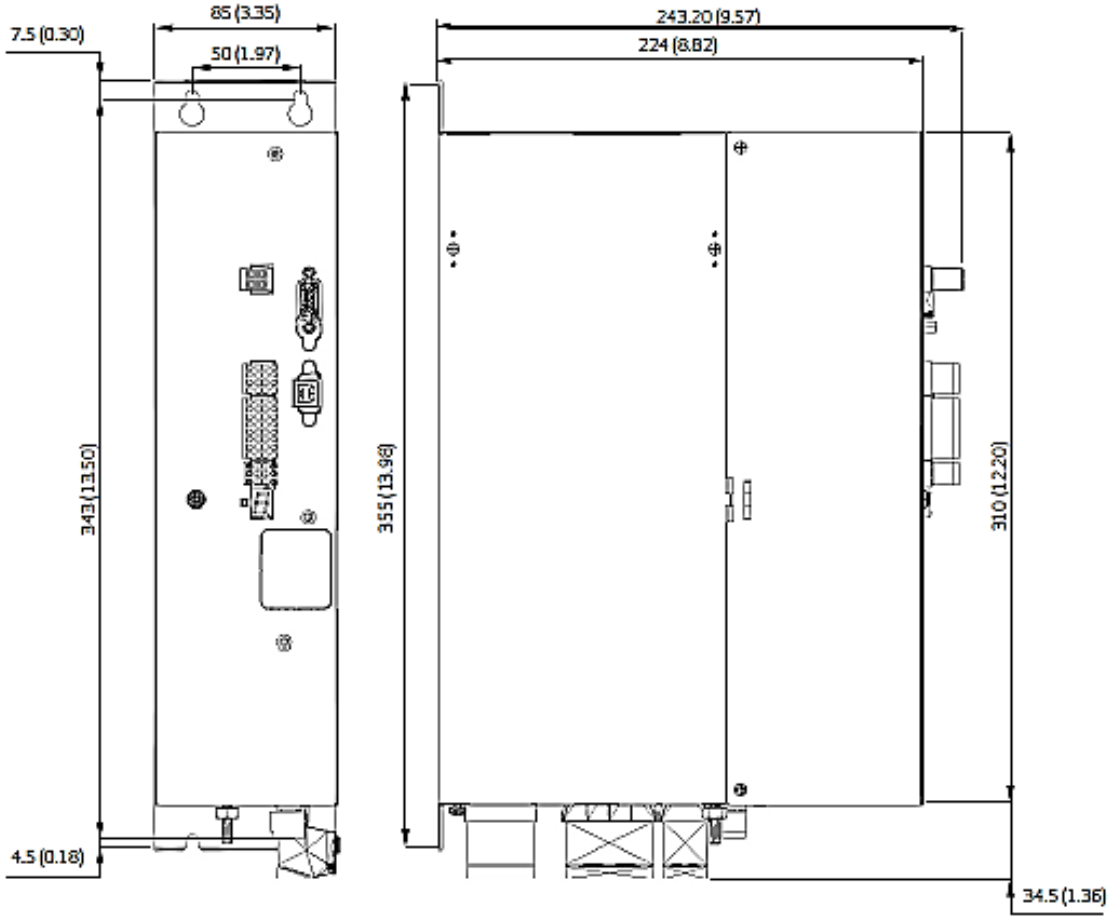
Axis Module 50 mm (1,97 inch)



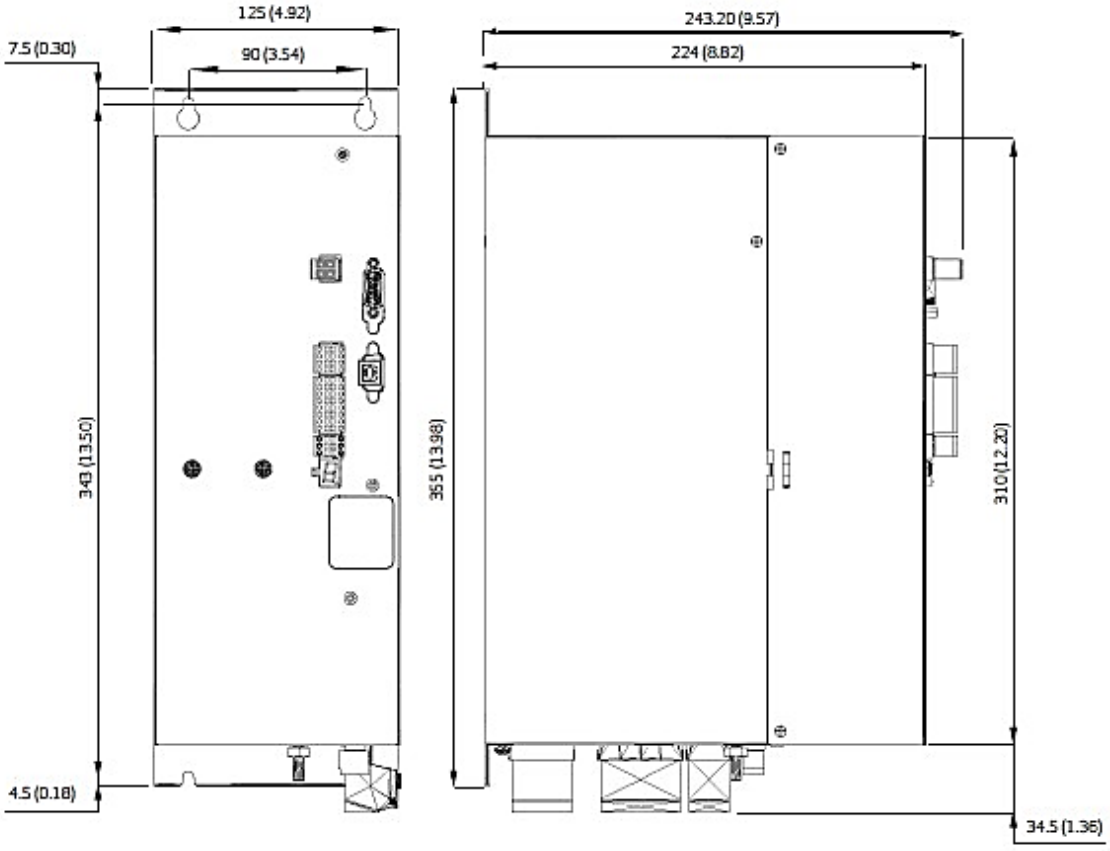
Axis Module 75 mm (2,95 inch)



Axis Module 85 mm (3,35 inch)



Axis Module 125 mm (4,92inch)



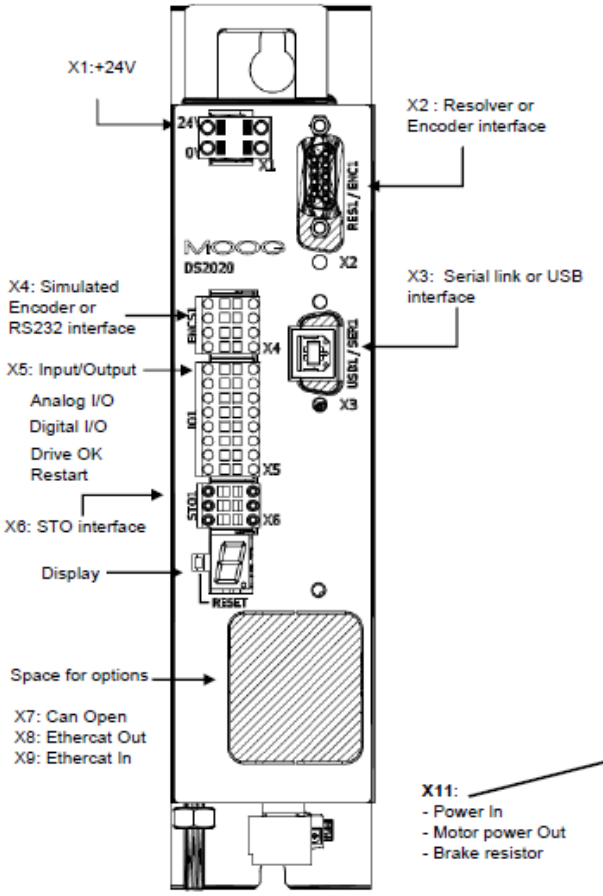
Available sizes

Mechanical hardware configuration			
Value	Type / Width	Rated current	Peak current
02	Single / 50mm L50A	2 Arms	4 Arms
04	Single / 50mm L50A	4 Arms	8 Arms
06	Single / 75mm L75A	6 Arms	12 Arms
08	Single / 75mm L75A	8 Arms	16 Arms
12	Single / 75mm L75B	12 Arms	22 Arms
16	Single / 85mm L85A	16 Arms	32 Arms
24	Single /85mm L85A	24 Arms	48 Arms
32	Single / 125mm L125A	32 Arms	64 Arms
48	Single / 125mm L125B	48 Arms	96 Arms

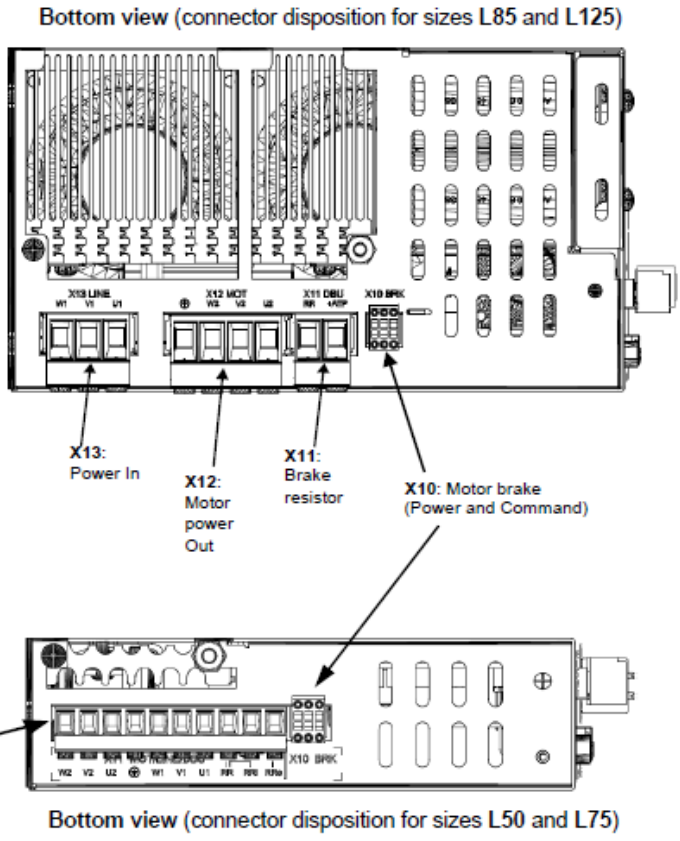
Note:

A verification of the codes and models must be made at the time of order in order to have the exact compatibility between the drives.

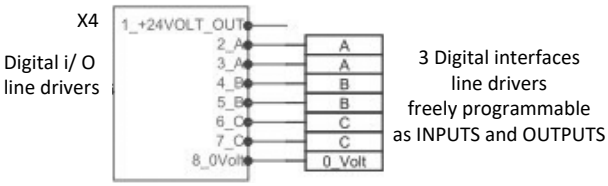
Connections



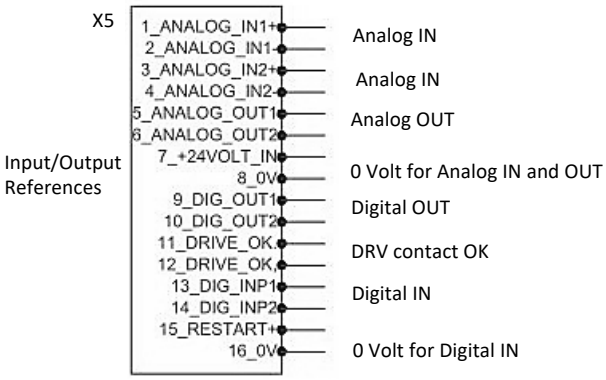
Front view
(connector disposition common to all sizes)



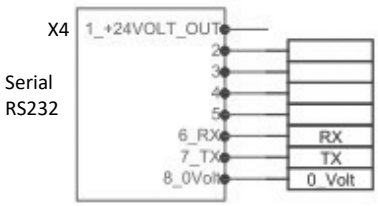
Connector as I/O Line Driver X4



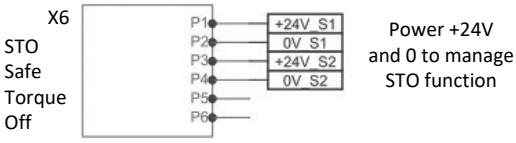
Reference Connector X5



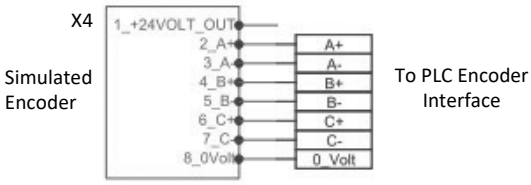
Connector as I/O and RS232 X4



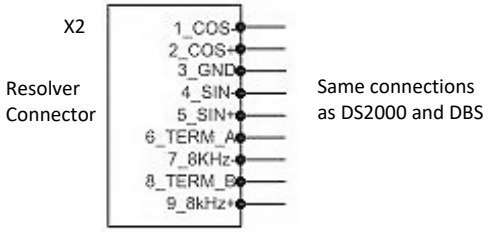
Connector STO X6



Simulated Encoder Connector X4



Resolver Connector X2



Size comparison

DS2000	Width	Height	Depth	Equivalent DS2020
A	95,5 mm	330 mm	208 mm	Size L50 e L75
B	120 mm	330 mm	208 mm	Size L85
C	165 mm	410 mm	208 mm	Size L125
D	265 mm	410 mm	208 mm	Size L125

DS2020	Width	Height	Depth	Equivalent DS2000
L50	50 mm	203 mm	199,4 mm	Size A
L75	75 mm	203 mm	199,4 mm	Size A
L85	85 mm	343 mm	243,2 mm	Size B
L125	125 mm	343 mm	243,2 mm	Size C e D

Preliminary operations details

1. Check the configuration of the machine equipped with the DS2000
2. Check motor models and their electrical characteristics
3. Depending on the number and the axis currents, choose the DS2020 modules
4. Verify if the power of the standard braking resistor is sufficient
5. Check the electrical wiring and make the necessary changes (especially for the sections "SAFETY", DRV OK and MOTOR OK to fit according to how it is managed by the machine)
6. Check the securing holes for the drives in the cabinets and if necessary prepare a bracket (Panel) to optimize drive replacement times
7. If possible, "read" the DS2000 axis calibrations to allow DS2020 to be programmed quickly with the settings required by the application; From the DS2000 manual you can make out any difference between the drive settings and the default.

   Contact the Moog operations of Casella for suggestions and possible verifications.

DS2000 interface towards DM2020

Cross Reference

Simulated Encoder

DS2000		DS20	
Signal	**Pin on J2C**	**Pin on X4**	**Signal**
A+	1	2	A+
A-	2	3	A-
B+	3	4	B+
B-	4	5	B-
C+	5	6	C+
C-	6	7	C-

Input reference

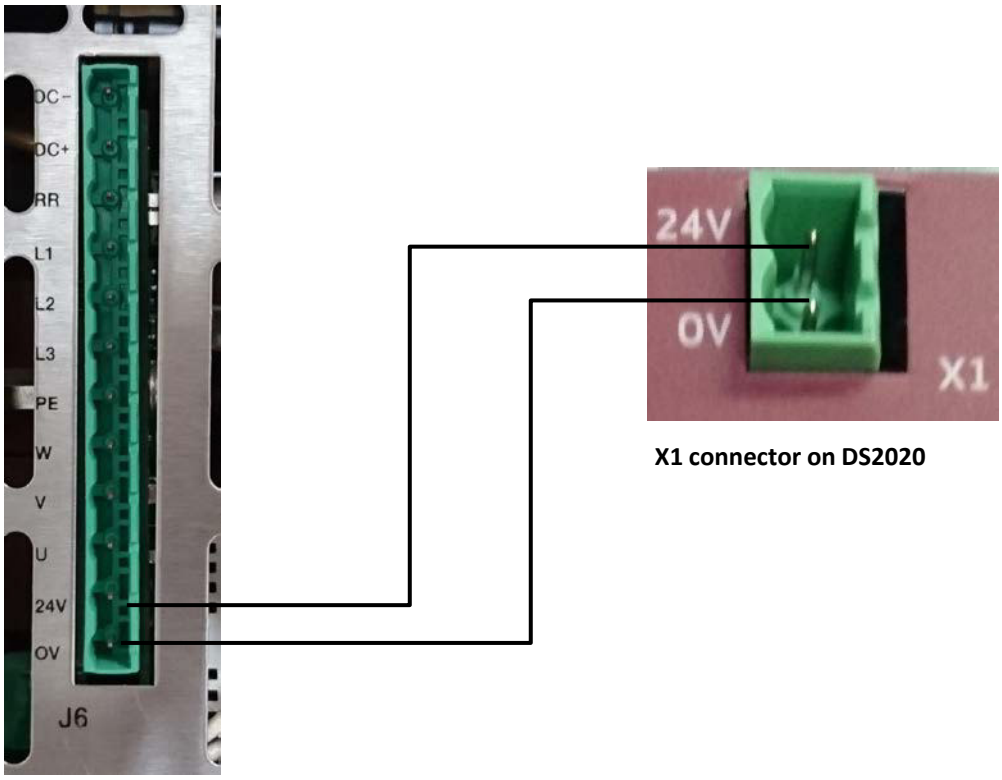
DS2000		DS2020	
Signal	**Pin on J2A**	**Pin on X5**	**Signal**
Vref+	1	1	IN AN 1+
Vref-	2	2	IN AN 1-
Ilimit+	3	3	IN AN 2+
Ilimit-	4	4	IN AN 2-

Enabling connector

DS2000		DS2020	
Signal	**Pin on J2B**	**Pin on X5**	**Signal**
+15V OUT	1		
0V	2	8 e 16	0VOLT DIG/ANAL
ANAL OUT	3	6	OUT AN2
TACHO OUT	4	5	OUT AN1
RESTART+	5	15	RESTART
RESTART-	6	8	0VOLT DIG.
DRV EN+	7	13	IN DIG 1
DRV EN-	8	8	0VOLT DIG.
REF EN+	9	14	IN DIG 2
REF EN-	10	8	0VOLT DIG.
DRV OK	11	11	DRIVE_OK
DRV OK	12	12	DRIVE_OK

Auxiliary power connector

DS2000		DS2020	
Signal	**Pin on J6**	**Pin on X1**	**Signal**
+24V	11	1	+24V
0V	12	2	0V



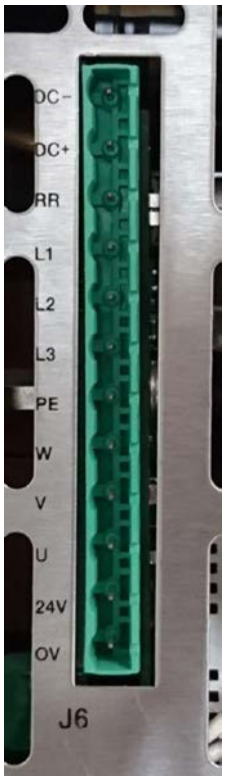
X1 connector on DS2020

J6 connector on DS 2000

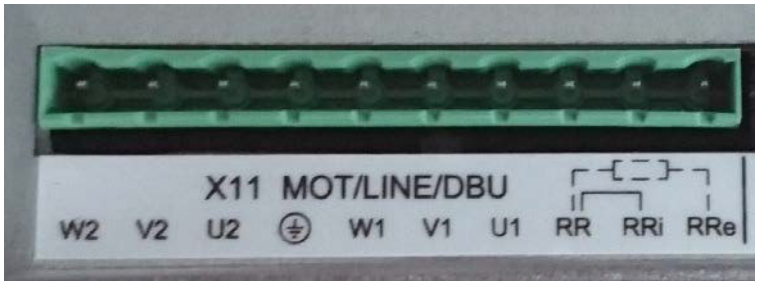
Power connections

DS2000 Connector	DS2020 Connector X11
DCBUS-	Not existing
DCBUS+	RR
Not existing	RRi
RR	RRe *see Note
L1	U1
L2	V1
L3	W1
PE	GND
W	W2
V	V2
U	U2

Note: It is necessary to remove the jumper between RRi and RRe on the X11 connector to use the external RR



J6 connector on DS2000



X11 connector on DS2020

DS2020 Settings

1. Set the motor parameters
2. Set drive parameters after converting the various settings to have the same functionality and calibration and leave the drive in "Local"
3. Perform the phasing of the motor without load if possible to control the motor and the cables
4. Set in "Remote", save and the drive is ready to go.

All these settings are described in the installation manual of the DS2020.

Note:

Through the GUI DX2020 you can duplicate all the customizations of the DS2000.

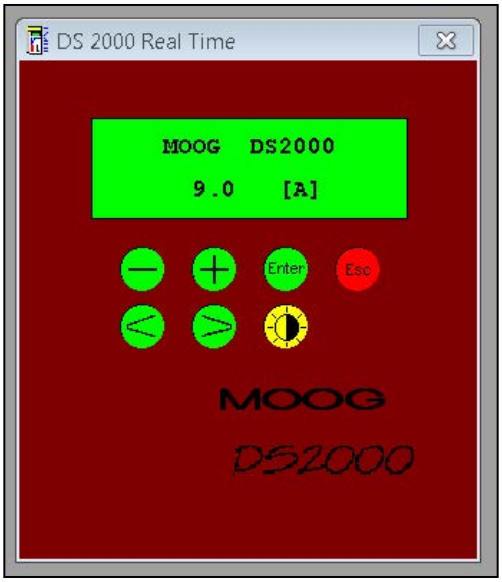
At the end of setup operations, save the configuration, turn it off and on again to make sure all settings work properly and to reset any alarms present.

If possible perform the timing with the motor disconnected from the load in order to avoid an inaccurate result.

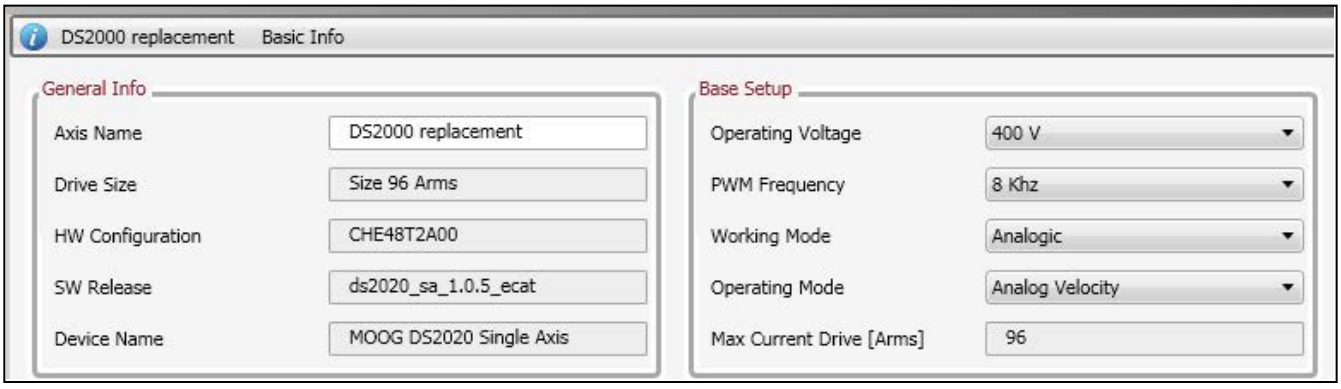
Operational Addendum:

Correspondence between Parameter References DS2000/DS2020

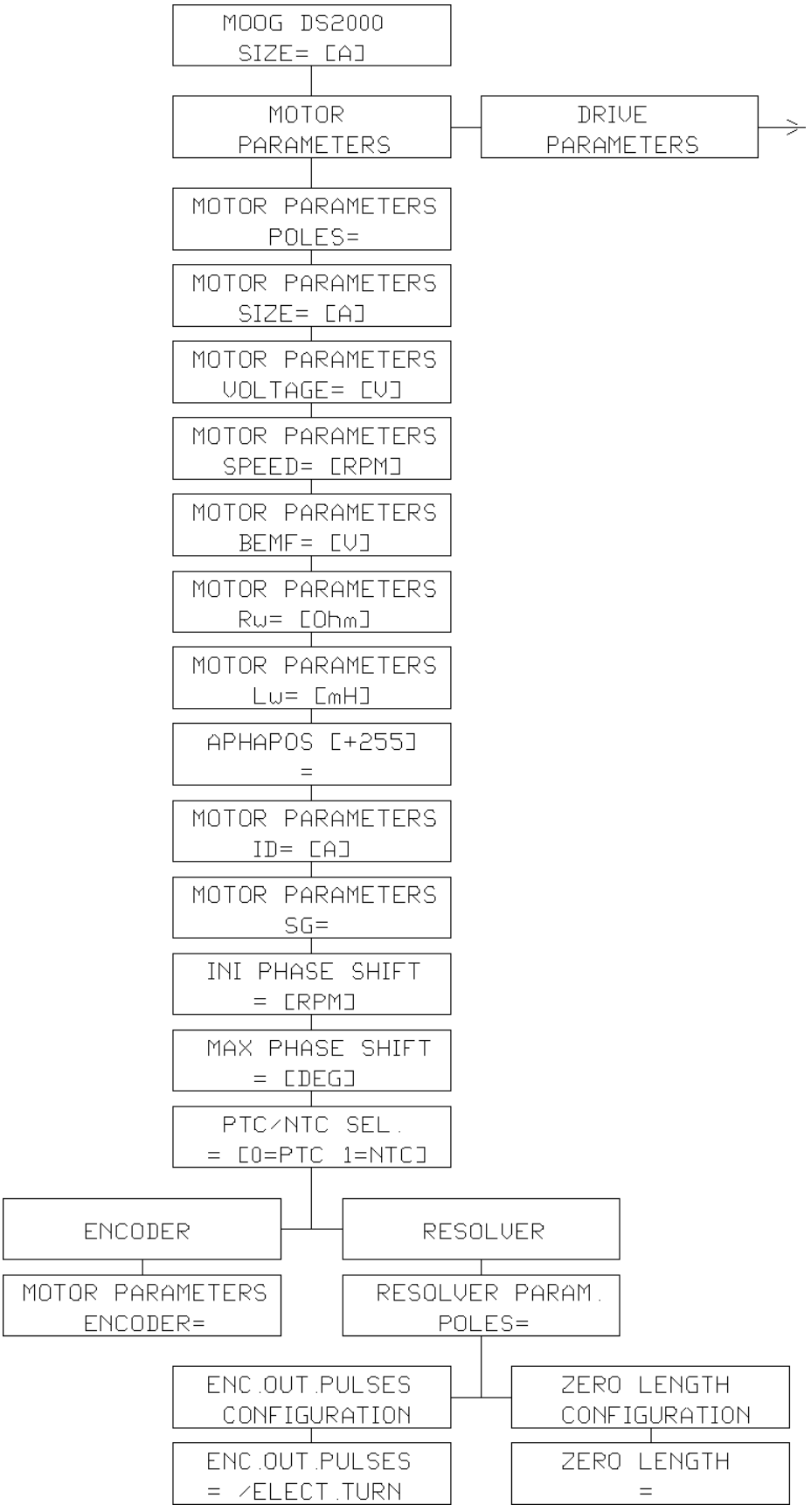
DS2000 Startup Display



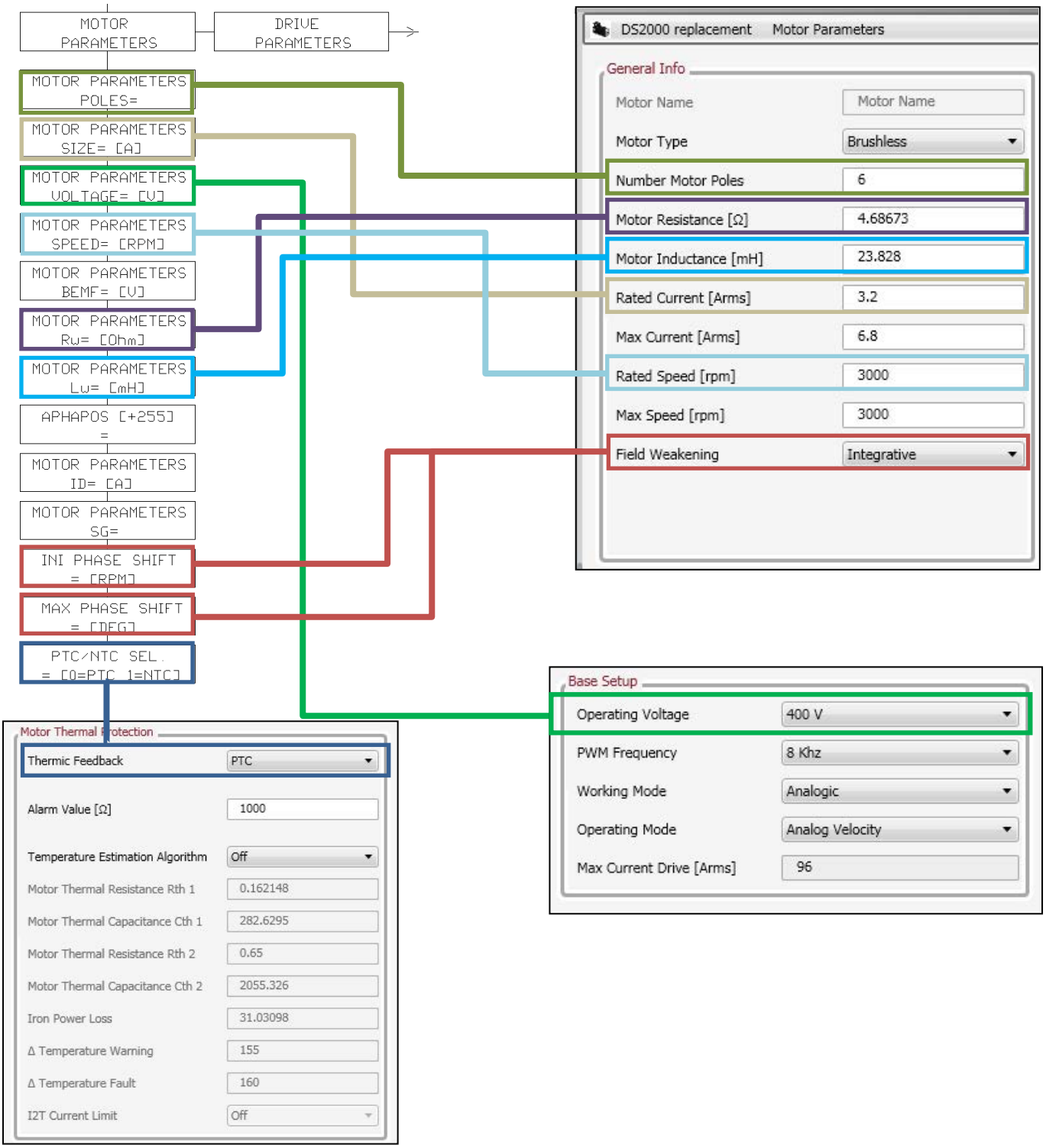
DS2020 GUI Starting Window

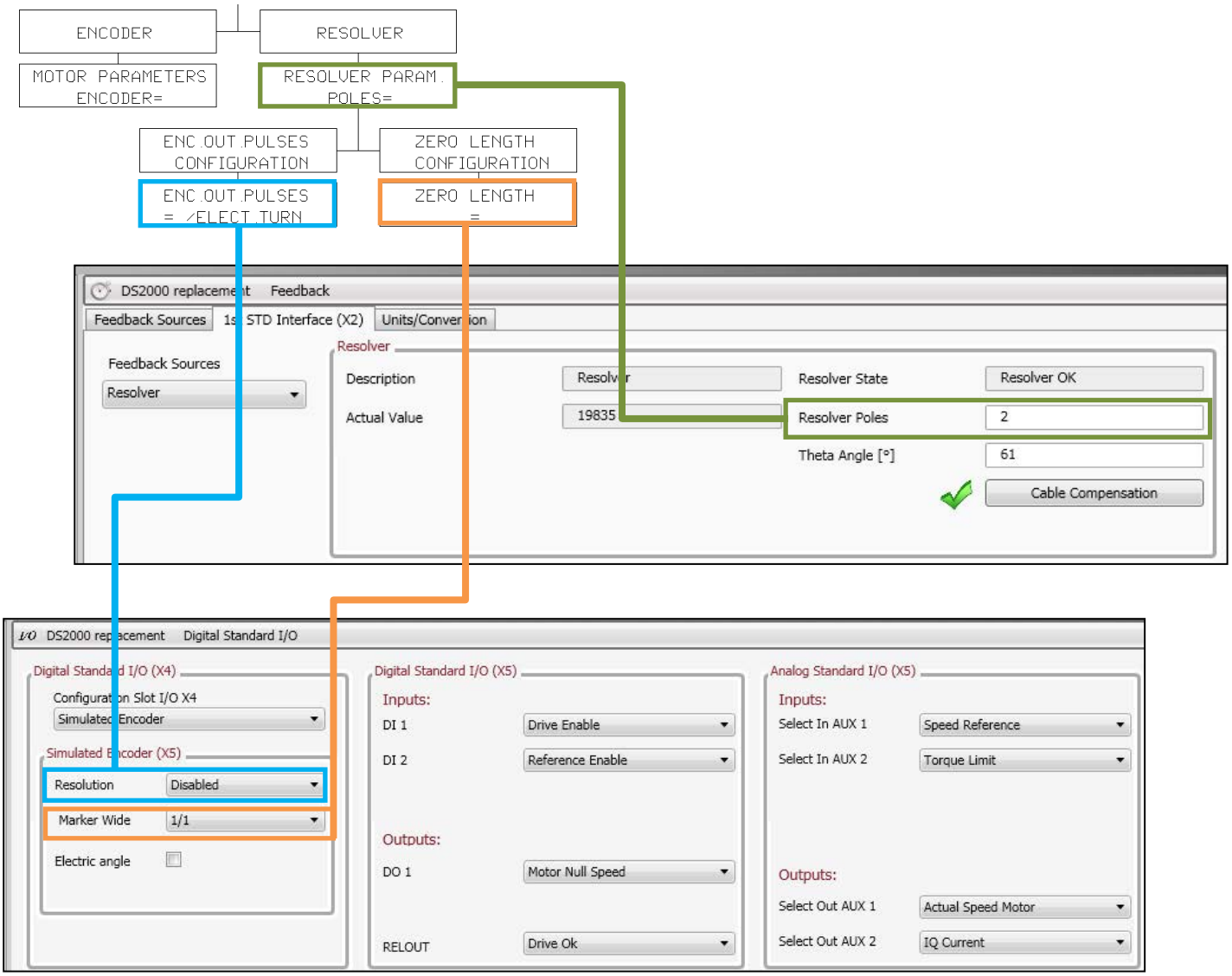


General Motor Parameters Menu DS2000

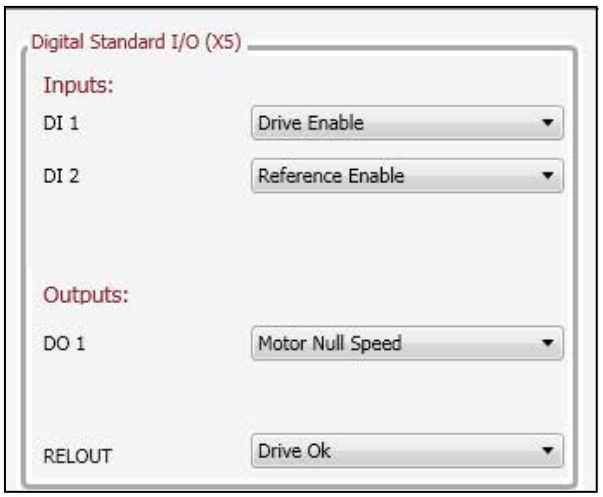


References between DS2000 and DS2020

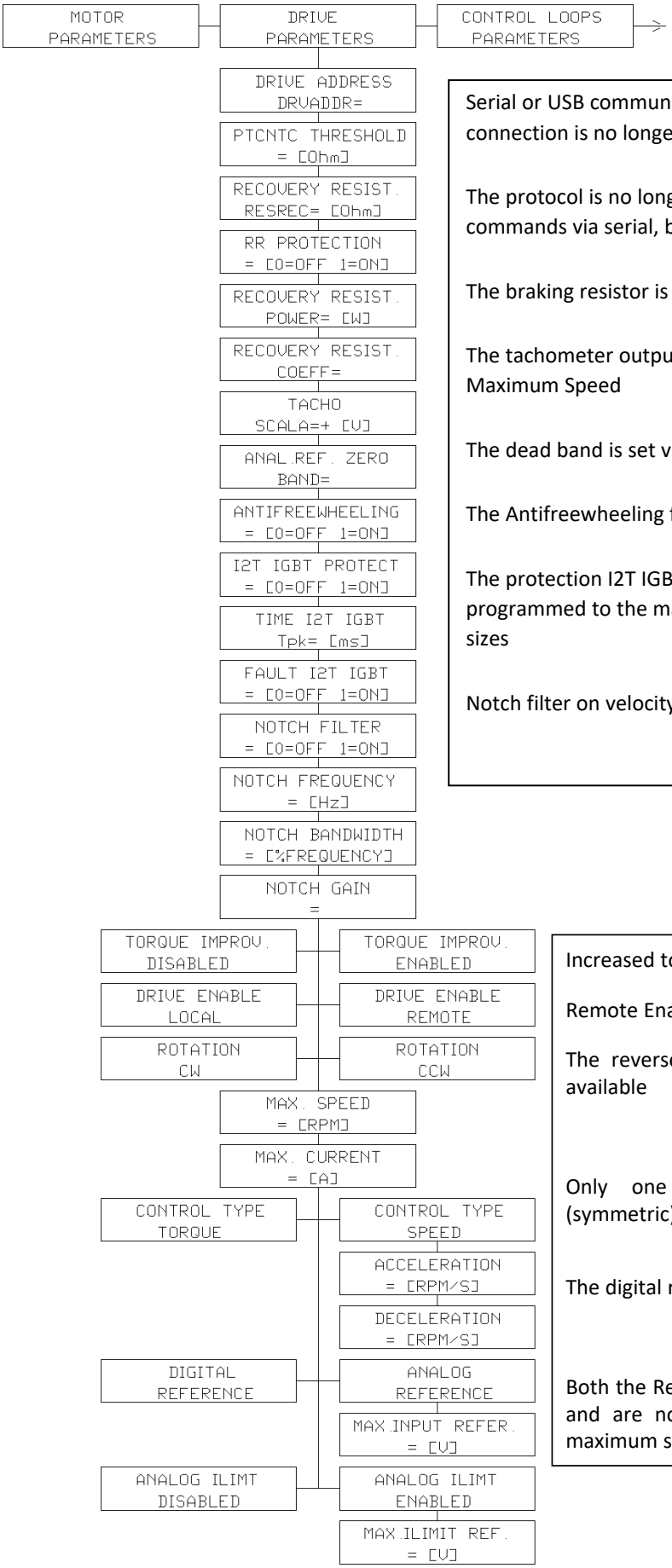




Set the I / O as indicated for SW releases ending with 0 (3.000, 3.100, 3.200). If you do not need the Analog TORQUE LIMIT, do not select anything in AUX IN 2.
If the DS2000 has a SW release ending with number 1 (3.101, 3.201 etc.) set REL OUT as follows:



Menu Parametri Azionamento



Serial or USB communication is just point-to-point; the multidrop connection is no longer supported.

The protocol is no longer available for accessing internal data and sending commands via serial, but only via CANOpen or EtherCat fieldbus or via GUI.

The braking resistor is not available.

The tachometer output is scaled permanently at 10 volts at the set Maximum Speed

The dead band is set via shell with the aux1deadband parameter in millivolt.

The Antifreewheeling function can be set as a reaction to the "fault"

The protection I2T IGBT is defined as "overcurrent" and is already programmed to the maximum allowed value for the IGBT used on different sizes

Notch filter on velocity ring is available

Increased torque see "field weakening"

Remote Enable becomes Analog

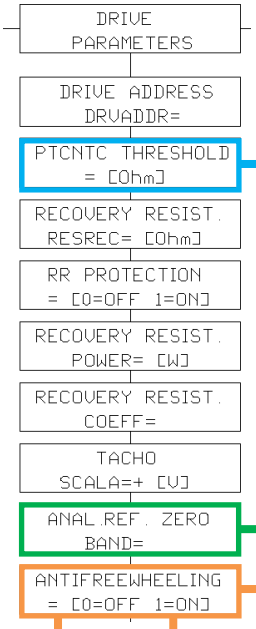
The reverse direction function via SW is no longer available

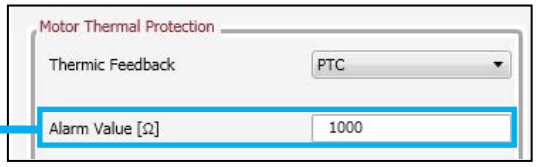
Only one acceleration and deceleration ramp (symmetric) is available

The digital reference is no longer salvable on the drive

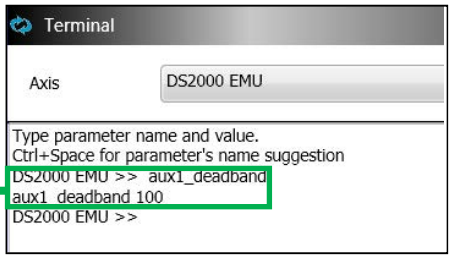
Both the Reference and the ILIMT are fixed at 10 volts and are no longer scalable unless you change the maximum speed

Drive Parameters Correspondence

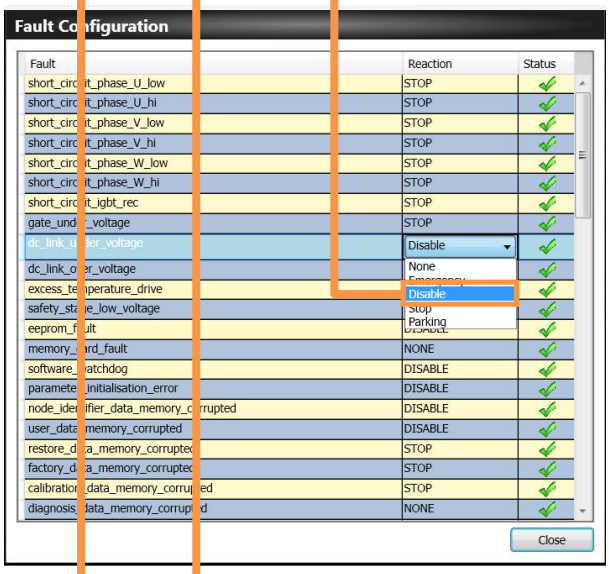




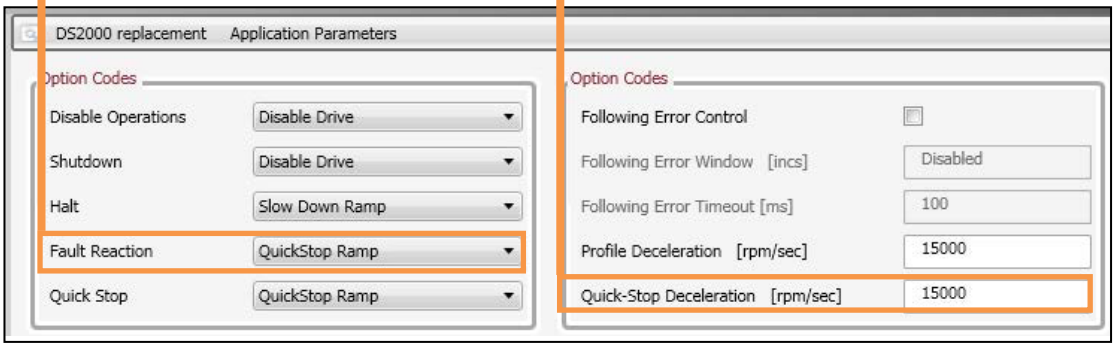
The threshold for the NTC probe is fixed in the drive to 6500 Ohm

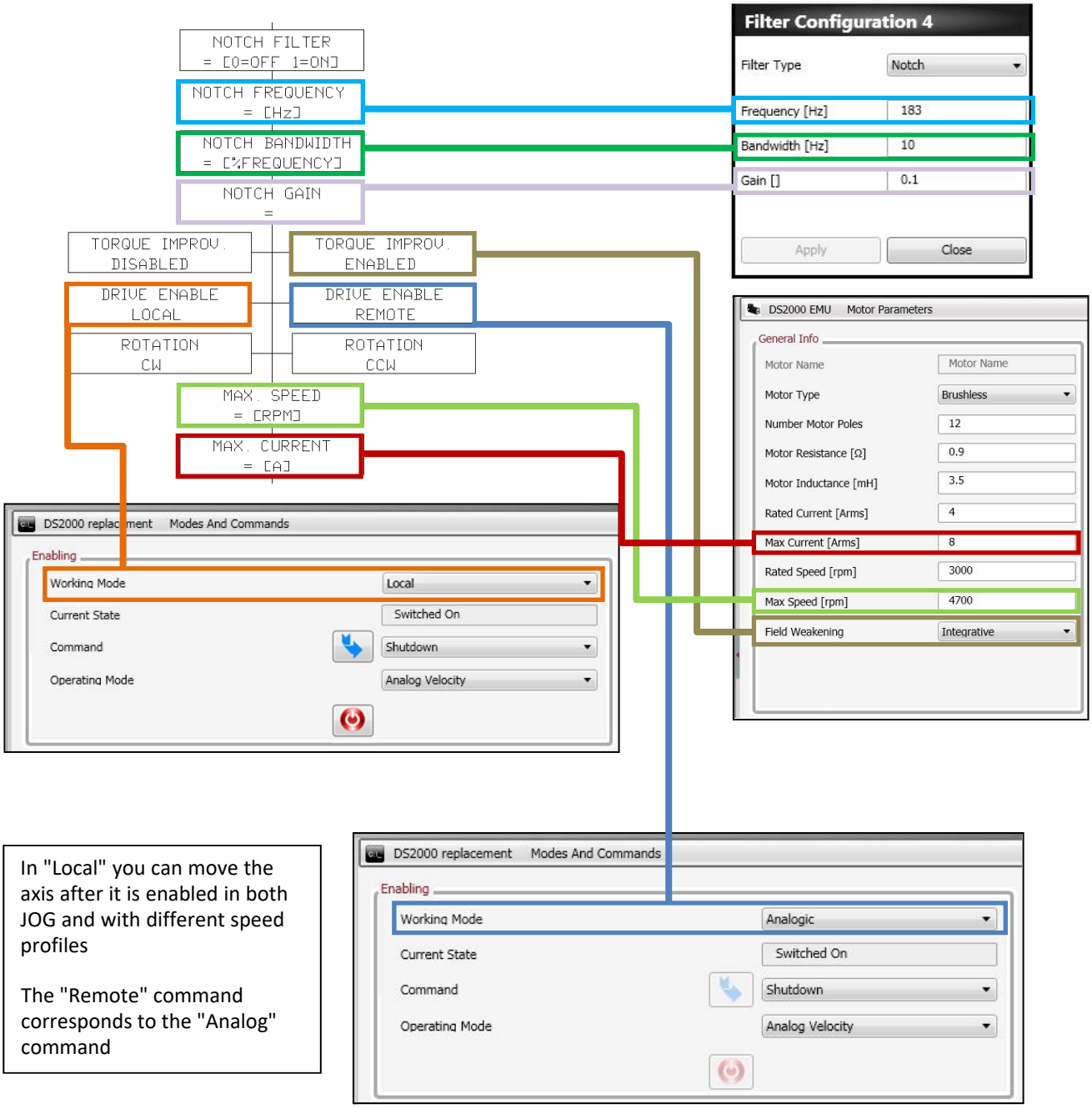


The aux1_deadband parameter is in internal units (1mV = 3 units).



Program alarms for Undervoltage OVT Drive OVT Motor as "Disable" and then program the Fault Reaction as Ramp Quickstop and set the corresponding deceleration to a value that the machine is able to handle (3000 rpm/s stops the machine in a second from 3000 rpm)

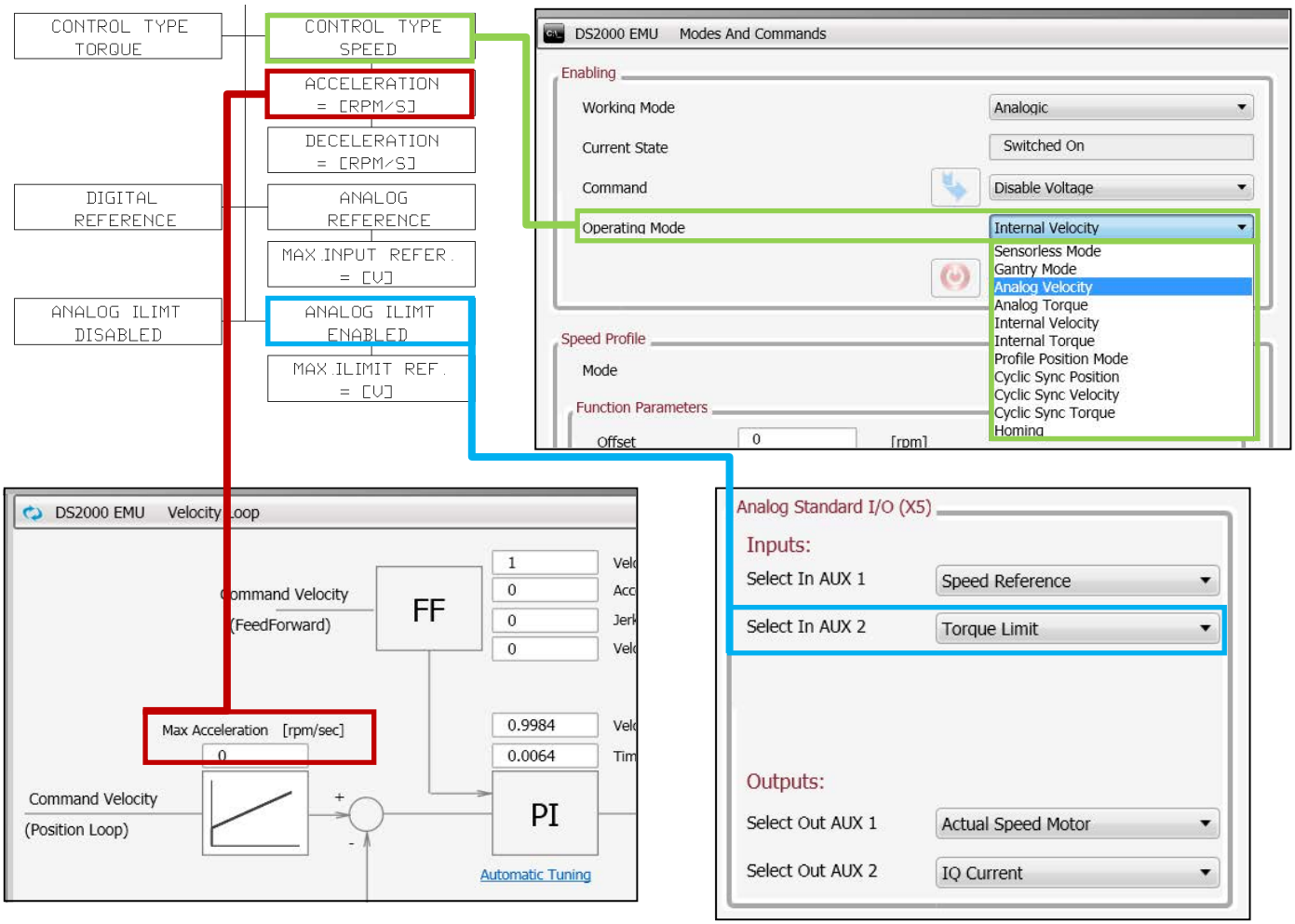


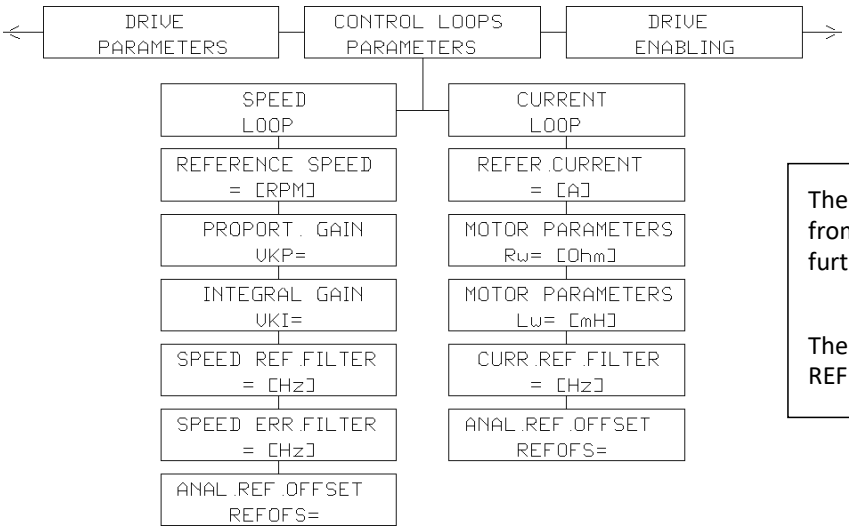


In "Local" you can move the axis after it is enabled in both JOG and with different speed profiles

The "Remote" command corresponds to the "Analog" command

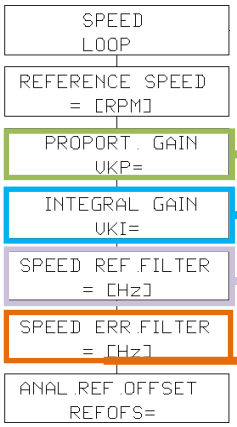
Note: In the Maximum Current field of the GUI, always insert the highest value between the two present in the DS2000 (Motor Size and Maximum Current)


CONTROL TYPE TORQUE
CONTROL TYPE SPEED
ACCELERATION = [RPM/S]
DECELERATION = [RPM/S]
DIGITAL REFERENCE
ANALOG REFERENCE
MAX INPUT REFER. = [V]
ANALOG ILIMT DISABLED
ANALOG ILIMT ENABLED
MAX ILIMIT REF. = [V]
DS2000 EMU Modes And Commands
Enabling
Working Mode
Analogic
Current State
Switched On
Command
Disable Voltage
Operating Mode
Internal Velocity
Sensorless Mode
Gantry Mode
Analog Velocity
Analog Torque
Internal Velocity
Internal Torque
Profile Position Mode
Cyclic Sync Position
Cyclic Sync Velocity
Cyclic Sync Torque
Homing
Speed Profile
Mode
Function Parameters
Offset
0
[rpm]
DS2000 EMU Velocity Loop
Command Velocity
(FeedForward)
FF
1
0
0
0
Max Acceleration [rpm/sec]
0
0.9984
0.0064
Command Velocity
(Position Loop)
PI
Automatic Tuning
Analog Standard I/O (X5)
Inputs:
Select In AUX 1
Speed Reference
Select In AUX 2
Torque Limit
Outputs:
Select Out AUX 1
Actual Speed Motor
Select Out AUX 2
IQ Current



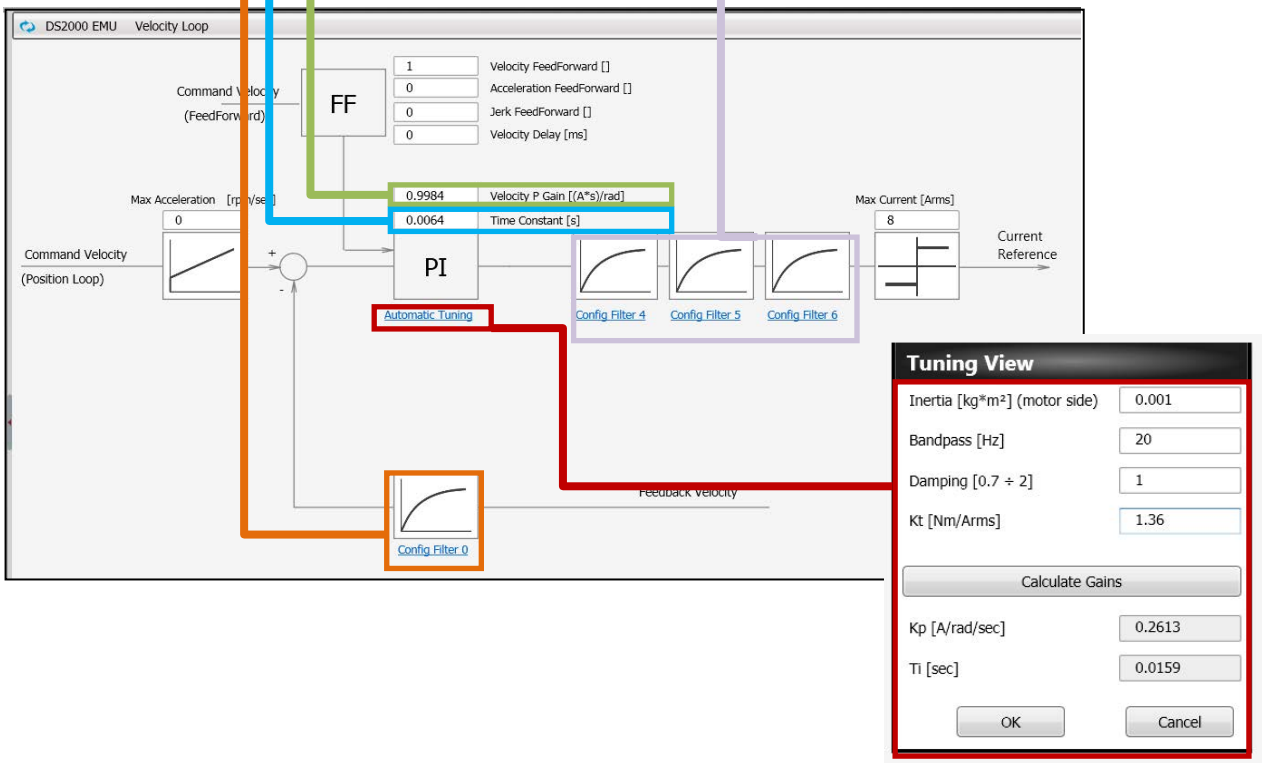
The current loop parameters are directly set from the "Motor Parameters" menu and no further setting is required.

The two parameters Speed REF and Current REF are no longer available.



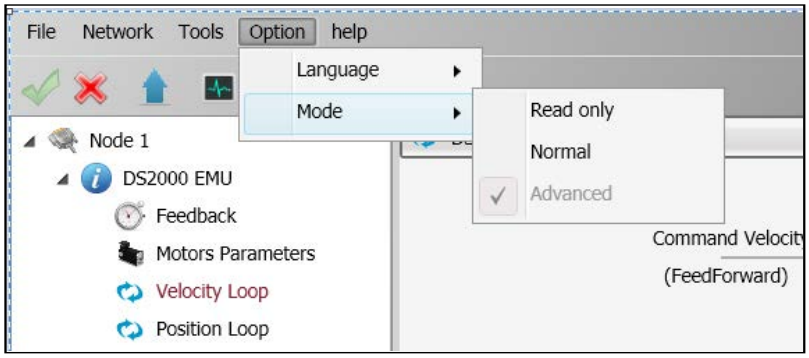
ATTENTION

The DS2000 uses a scale for gains in internal units while the DS2020 employs physical units. Use the "Auto Calibration" to indicate the gains to be set, entering an inertia indicative of the load and the torque constant of the motor for the calculation.
Set the bandwidth to 75/100 Hz.

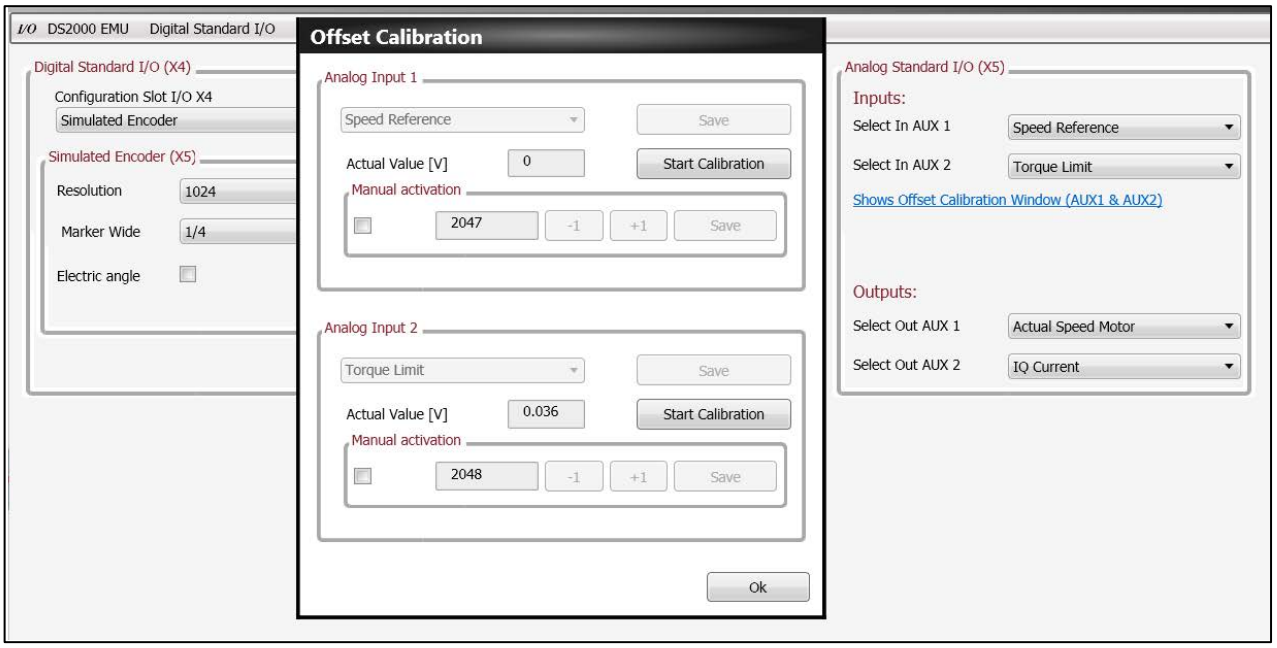


Offset Calibration of Analog Input for DS2020

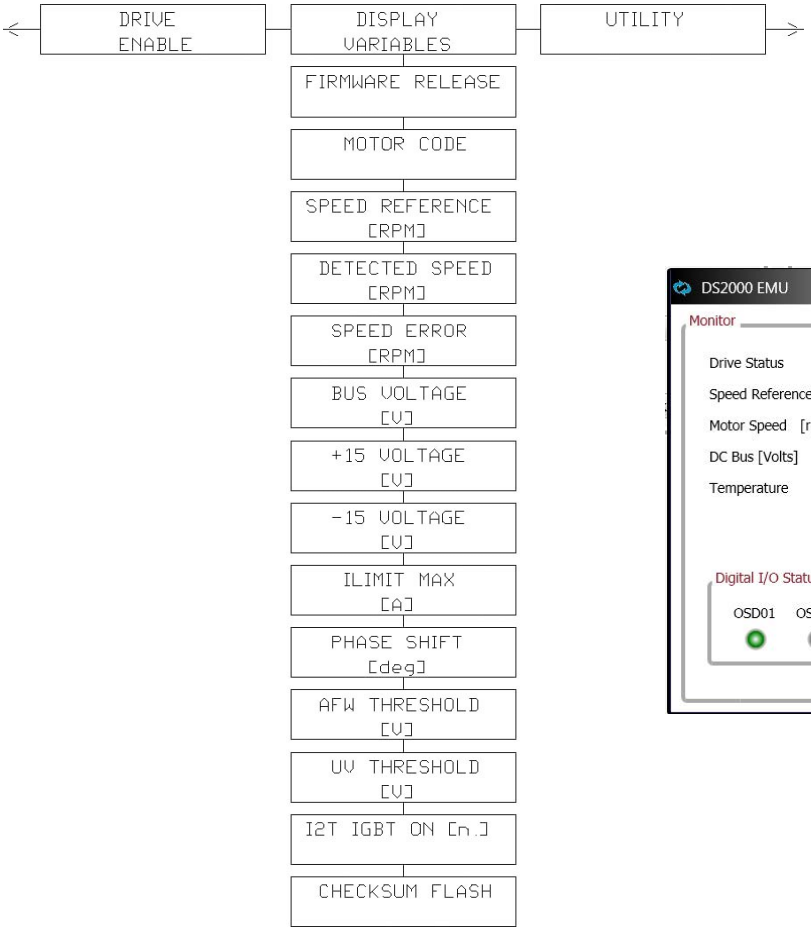
Go to the "Advanced" mode of the GUI

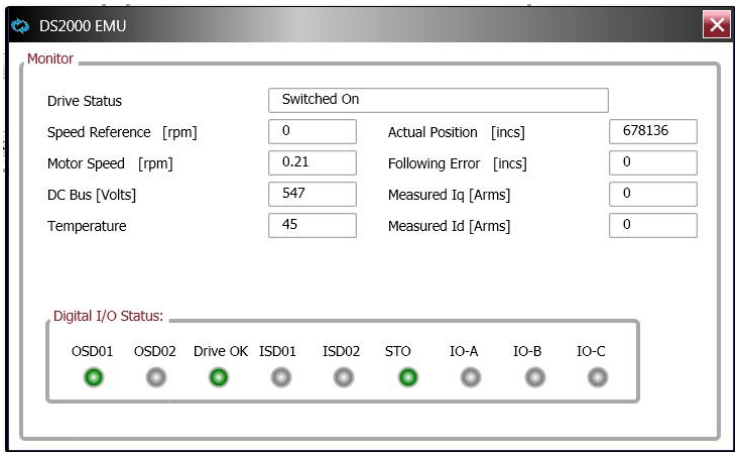


Go to the I / O page and click Show Offset Calibration Window. Press Start Calibration and wait for execution. When done press Save.

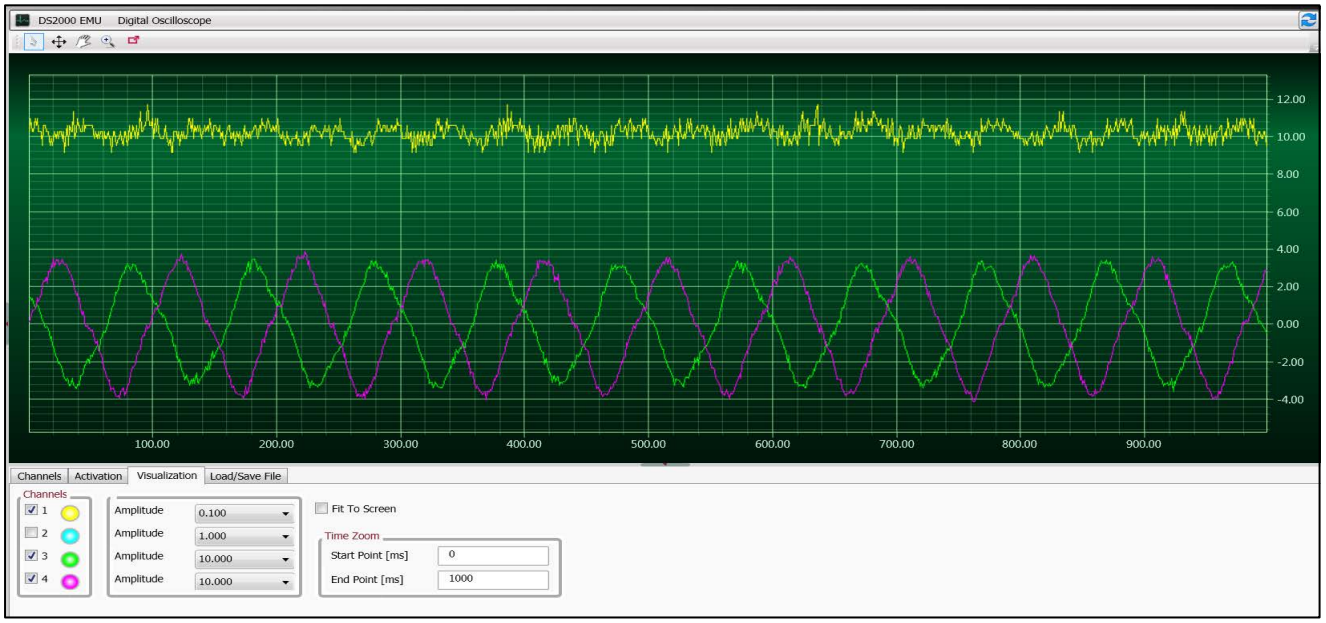


Display Variables Menu

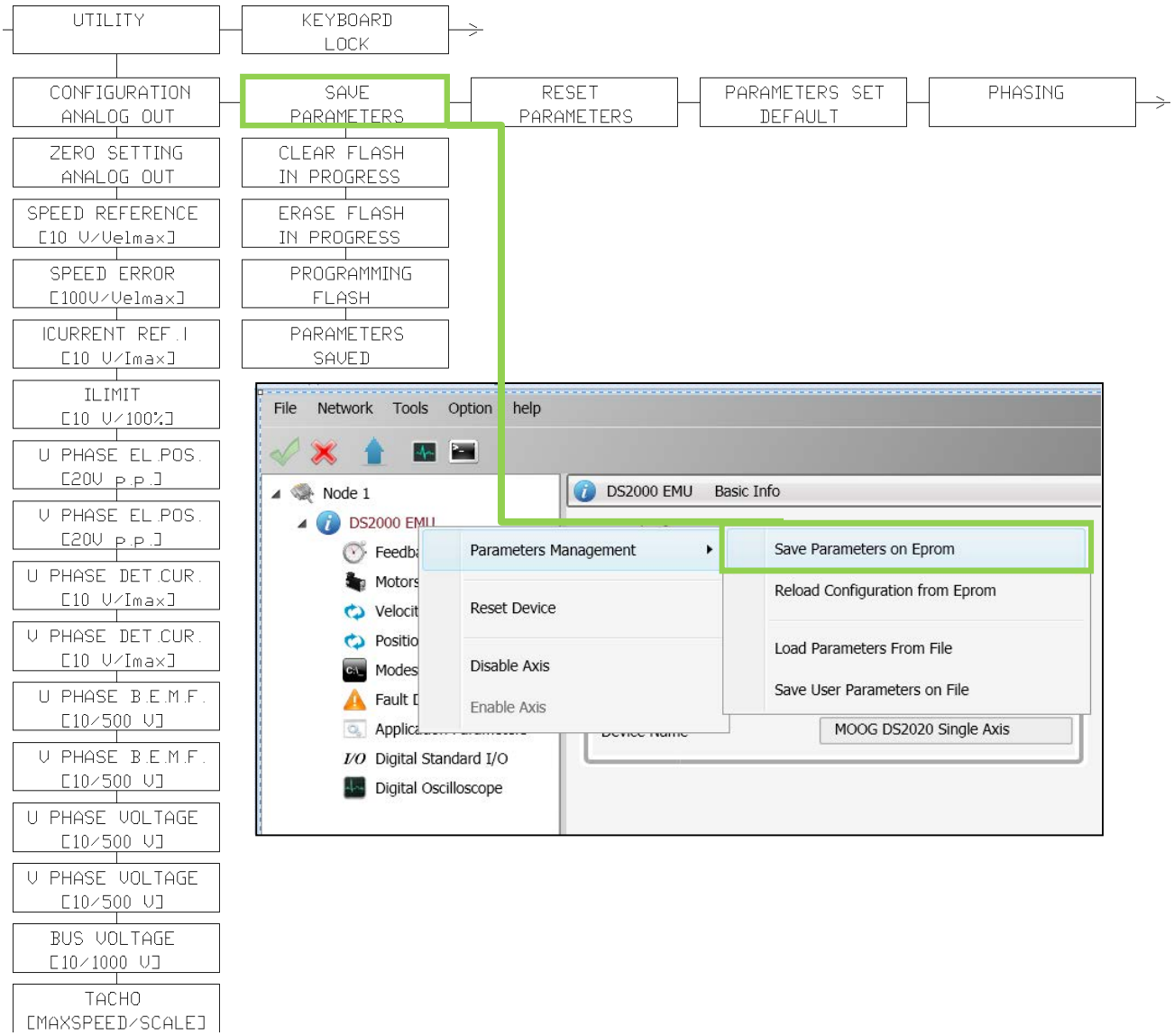




More information can be obtained with the oscilloscope of the DS2020.

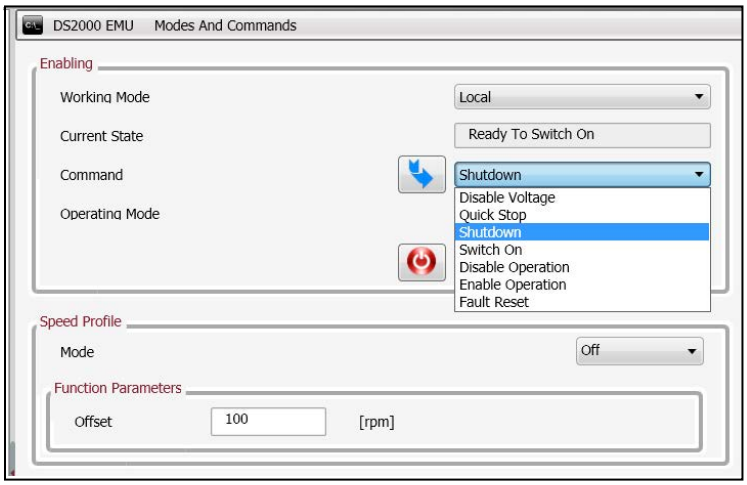


Utility Menu

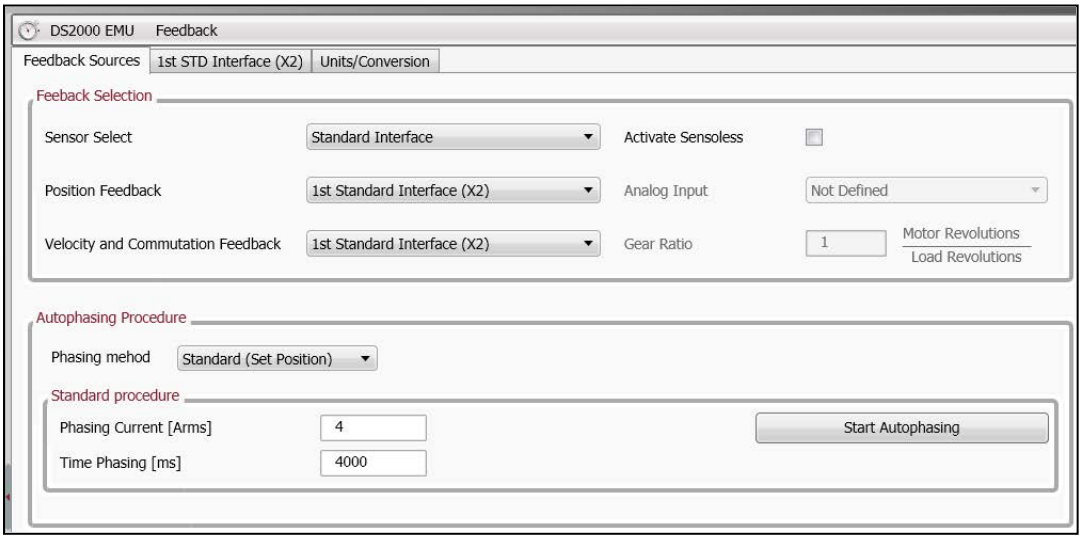


Autophasing

The procedure is as follows:
Set the DS2020 Drive in Local, with three-phase current provided, Connected STOs, Configured Resolver, Resolver Cable Compensation Executed, Motor Parameters Inserted; if possible free the motor from any load. Put the drive first in the "Power Off" and then in the "Power On" position.



Go to the Feedback menu, set a phasing current equal to the nominal motor current then press Start Autophasing for its execution.



Note
The DS2000 APHAPOS parameter corresponds to the THETA ANGLE parameter of the DS2020. However, it is not a direct match because the two parameters apply different scales. As a result, you cannot simply transfer the APHAPOS value of the old drive to the new one. To obtain the correct THETA ANGLE value you must perform the phasing procedure.

For any information or request for assistance please contact
Moog Casella
Via Avosso 94, 16015 Casella, (GE) - Tel +3901096711 - email: info.casella@moog.com