EN

Drivert-1000 ®

USER MANUAL

WARNING!

Since this equipment is powered with a mains voltage of 230 Vac 1~ 50/60 Hz, to avoid harming people or damaging things, we recommend you follow the instructions given in this manual with the utmost care. Any work that needs to be done on the equipment as well as its installation, starting and servicing, should be carried out by specialized people who are aware of all the safety regulations and procedures described herein. The drive conforms to the verifications contemplated by the product standard CEI EN 61800-3 of 09/96 and has been designed to work in an industrial environment which makes it unsuitable for use on a low voltage public mains for domestic use.

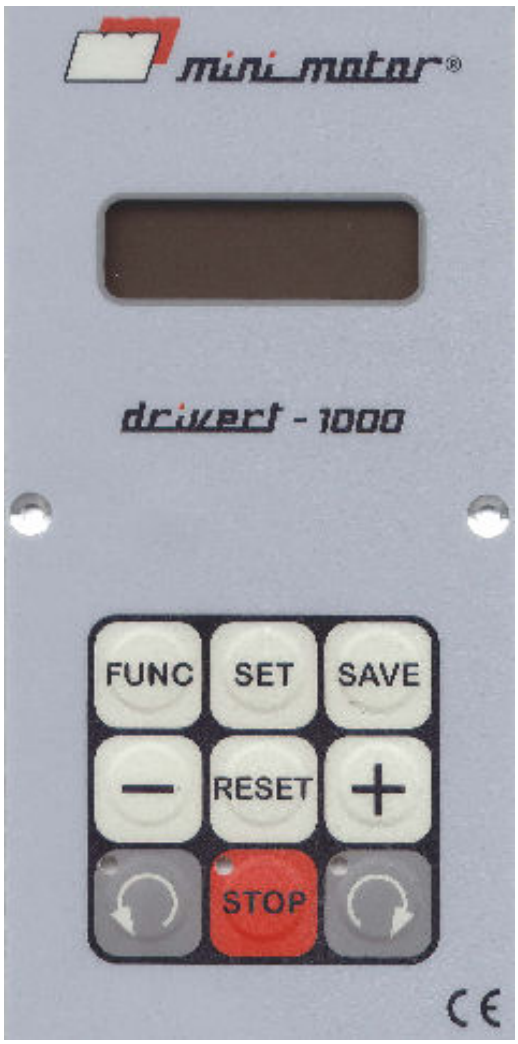
1 – TECHNICAL DESCRIPTION

Drivert-1000 is a digital drive with a 10 KHz SPWM system and a sinusoidal output current. With this drive it is possible to obtain high performances controlling SPEED, TORQUE and POSITION of permanent magnet synchronous servomotors (AC Brushless) up to 1000W with feedback from a resolver.

2 – TECHNICAL SPECIFICATIONS

Input:	Supplied directly by the mains, 230 Vac ±10% - 50/60 Hz Backup supply, 24 Vdc 1A
Output:	6 A cont. / 12 A max (5 Sec) / 15 A peak. Electromagnetic brake supply NC 24 Vdc 12 W Max
Digital I/O:	2 torque/speed enable inputs 7 profile selection inputs (128 motion profiles) 1 strobe input for execution of the selected profile 1 resetting input (home switch) 2 limit switch inputs cw/ccw 2 Jog speed control inputs Jog (cw/ccw) 8 outputs for indicating Fault, I^2T, Limit switch, Enabled, Target Position, Target Speed, Homing, Sync. 1 encoder emulation output (1-1024 Imp 5V Line driver A,B,Z) 1 encoder input (5V Line driver / 24V push-pull A,B,Z or Pulse/Direction 120 Khz Max)
Analogue I/O:	1 speed reference input ±10V 1 torque reference input ±10V 1 PTC or NC contact (motor protection) input 1 resolver input (2 poles 10Khz 10Vac) 1 output ±10V monitor feedback speed 1 output ±10V monitor output current
Interfaces:	9-key keyboard 5-digit display RS232 / RS485 serial connection Canopen field bus (Cia DS 301 V4.02 / DSP 402 V2.0)
Protections:	Voltage, current, overtemperature (motor or drive) resolver failure, EEprom failure
Instructions for use:	Operating temperature from 0 to 40°C Max. humidity 90% without condensate IP20 protection level

3 – DESCRIPTION OF THE FRONT KEYBOARD



FUNC :

1. By pressing and releasing this key immediately you gain access to the programmable functions (F 000-F 199).
2. By pressing and keeping this key depressed for 1 second you gain access to programming the 128 motion profiles

SET :

1. Either inside the functions or motion profiles this key gives the value stored. Press SET repeatedly to select the number to change (blinking).
2. Out of the functions or motion profiles, it is used to change the display indication of the following measurements:
   a. **RPM** Rotation speed
   b. **AMPER** Motor input
   c. **VOLT** Supply voltage
   d. **TEMPE** Internal Drivert temperature
   e. **POSI** Position
   f. **PROFI** Gives the number of the motion profile executed
3. Pressed during Drivert ignition, it commands motor timing (keep depressed until the display signals “SETUP”)

SAVE : Saves the functions in EEPROM.

RESET :

1. Resets the values of the functions stored in the EEPROM
2. Pressed during Drivert ignition it resets functions and motion profiles at the Default values

fig. 1

+ : Increases the value of a function or speed.

- : Reduces the value of a function or speed.

↺: Command to turn in the counter clockwise direction; a green LED stays on during rotation in the counter clockwise direction.

STOP : Motor stop command; a red LED is on when stopping.

↻: Command to turn in the clockwise direction: a green LED stays on during rotation in the clockwise direction

4 – DESCRIPTION OF CONNECTIONS

CAUTION!
This drive contains capacitive circuits that can remain live for short periods of time even after turning off. Bearing this in mind, it is essential to wait a few minutes before attempting any work inside the drive or on the connections.

4.1 – TERMINAL BLOCK LAYOUT

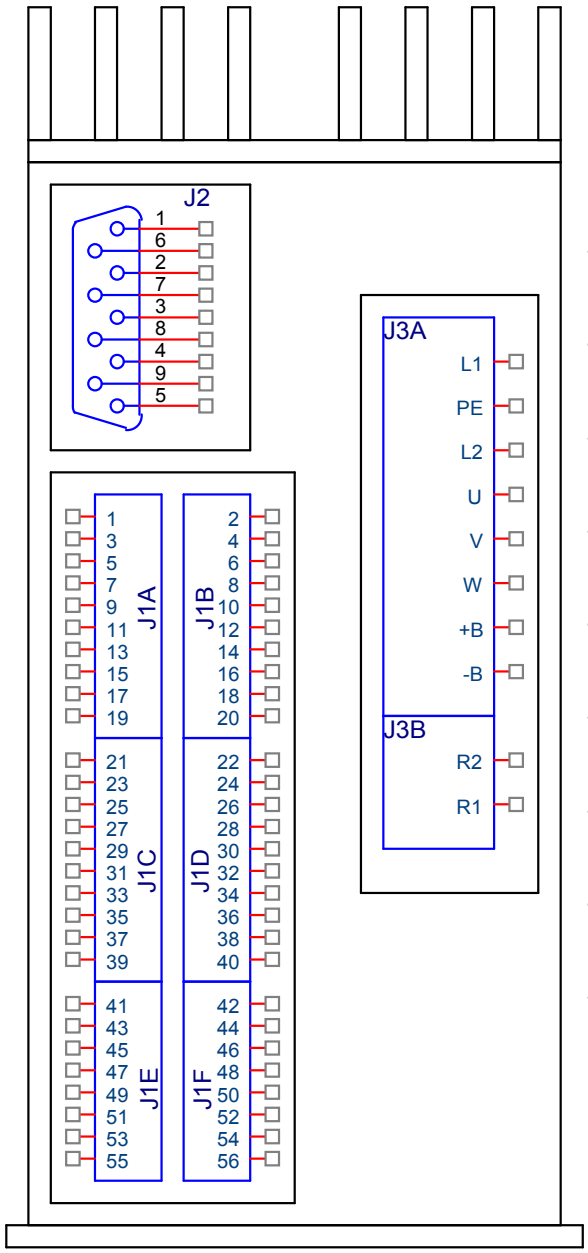


fig. 2

J1A **I/O terminal block**

J1B **I/O terminal block**

J1C **I/O terminal block**

J1D **I/O terminal block**

J1E **I/O terminal block**

J1F **I/O terminal block**

J2 **Resolver connector / PTC**

J3A **Supply terminal block / motor / brake.**

J3B **Terminal block for the external resistance connection.**

4.2 – POWER CONNECTIONS

4.2.1 - CONNECTOR J3A /DRIVE J3B

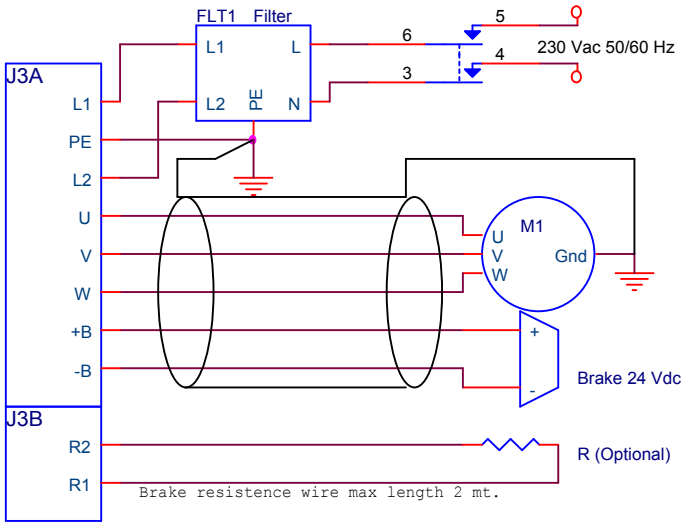


fig. 3

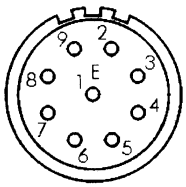
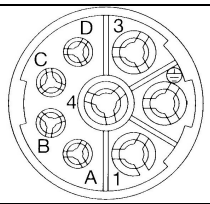
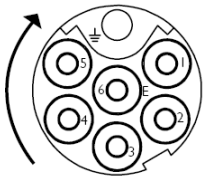
J3A	DESCRIPTION	VALUE		
L1	Supply	1~ 230Vac ±10% 50/60Hz 6 A		
PE				
L2				
U	Motor output	3 ~ 0–220 Vac 6 A cont. / 12 A max (5 Sec) / 15 A peak.		
V				
W				
+B	Brake output	+24 Vdc 0.5 A (Max)		
-B		0 Vdc		
R1	External braking resistance output		MIN	MAX
		Voltage	450 Vdc	
R2		Power	100 W	200 W
		Resistance	33 Ohm	56 Ohm

CAUTION!
The motor cable must be the screened type, the shielding must connected to ground (PE) on both the drive and motor side.
The external braking resistance connecting cable must be as short as possible to limit over voltages (max.2 m).

External braking resistance is necessary when, due to high load inertia, the drive protects itself due to maximum voltage during the stopping phases In such an event connect an external power resistance that will dissipate the kinetic energy accumulated in deceleration. Resistance value should not exceed the minimum and maximum limits indicated in the table.

NOTE: If a NC (normally closed) type brake is used, it is controlled by the T_Enable input (torque enable) or via the CW in the SWITCHED-ON state (Canopen remote control).

4.2.2 – MINIMOTOR MOTOR POWER CONNECTORS

DESIGN	TYPE	PIN	SIGNAL	DESCRIPTION
	M23 9 POLES	1	PE	Ground
		2	U	Phase U
		3	V	Phase V
		4	W	Phase W
		5	+ BRAKE	Positive brake supply 24 VDC
		6	- BRAKE	Negative brake supply 24 VDC
	M23 8 POLES	1	U	Phase U
		2	PE	Ground
		3	W	Phase W
		4	V	Phase V
		A	+ BRAKE	Positive brake supply 24 VDC
		B	- BRAKE	Negative brake supply 24 VDC
	M17 7 POLES	⏚	PE	Ground
		1	U	Phase U
		2	V	Phase V
		3	W	Phase W
		4	+ BRAKE	Positive brake supply 24 VDC
		5	- BRAKE	Negative brake supply 24 VDC

4.3 - RESOLVER CONNECTIONS

4.3.1 - CONNECTOR J2 DRIVE

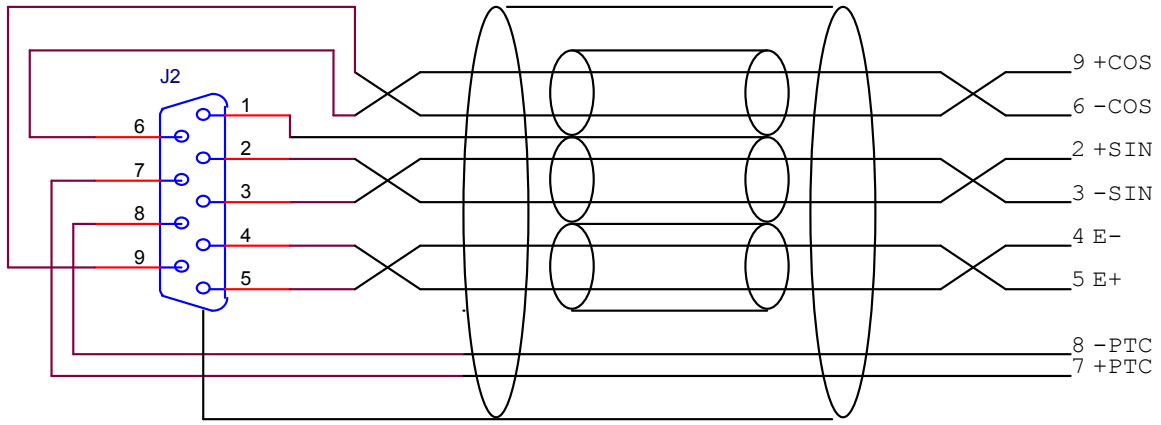
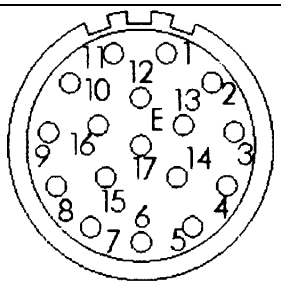
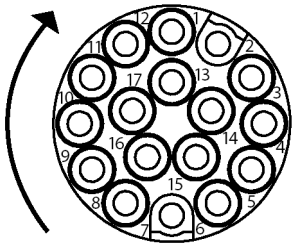


fig.4

4.3.2 – MINIMOTOR MOTORS RESOLVER CONNECTORS

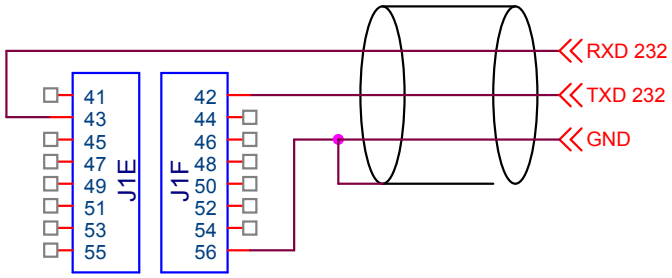
M23 17 POLES	M17 17 POLES
	

J2	Signal	17-pole motor connector	Description
1	GND	Do not connect	Earth for connecting the pairs screen
2	+SEN	2	Resolver secondary winding input
3	-SEN	3	Resolver secondary winding input connected to Gnd
4	E-	4	Resolver primary winding supply
5	E+	5	Resolver primary winding supply
6	-COS	6	Resolver secondary winding input connected to Gnd
7	+PTC	7	PTC heat probe or NC contact
8	-PTC	8	PTC heat probe or NC contact
9	+COS	9	Resolver secondary winding input

ATTENTION!
To connect the resolver it is essential to use a cable made up of 3 pairs of twisted conductors, screened individually and 2 conductors + overall screen. The screens of the 3 pairs must be connected to pin 1 only on the drive side, while the overall screen must be connected to the metal casing of connector J2.

4.4 - SERIAL CONNECTION

4.4.1 - RS232 CONNECTOR J1E / DRIVE J1F

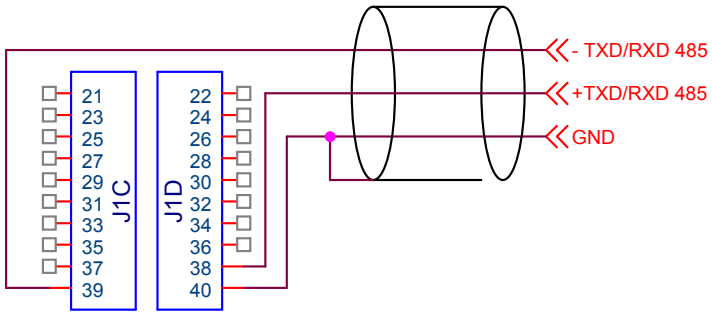


J1 E/F	SIGNAL
43	RXD 232
42	TXD 232
56	GND

fig. 5

ATTENTION!
Use screened cable with screening connected to GND only on the drive side. Separate signal cables from power cables

4.4.2 - RS485 CONNECTOR J1C / DRIVE J1D

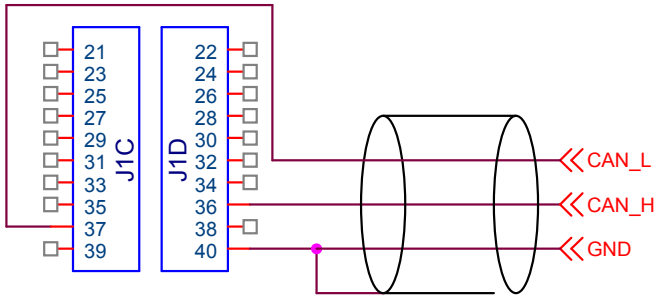


J1 C/D	SIGNAL
38	+TXD/RXD485
39	-TXD/RXD485
40	GND

fig. 6

ATTENTION!
Use screened cable with screening connected to GND only on the drive side. Thirty two is the maximum (theoretical) number of devices in parallel. Use a 120Ω ¼ W termination resistance at the beginning and end of the line. Separate signal cables from power cables

4.4.3 - CAN CONNECTOR J1C / DRIVE J1D



J1 C/D	SIGNAL
36	CAN_H
37	CAN_L
40	GND

fig. 7

ATTENTION!
Use screened cable with screening connected to GND only on the drive side. One hundred and twenty seven is the maximum (theoretical) number of devices in parallel. Use a 120Ω ¼ W termination resistance at the beginning and end of the line. Separate signal cables from power cables

4.5 - I/O TERMINAL BLOCK DESCRIPTION

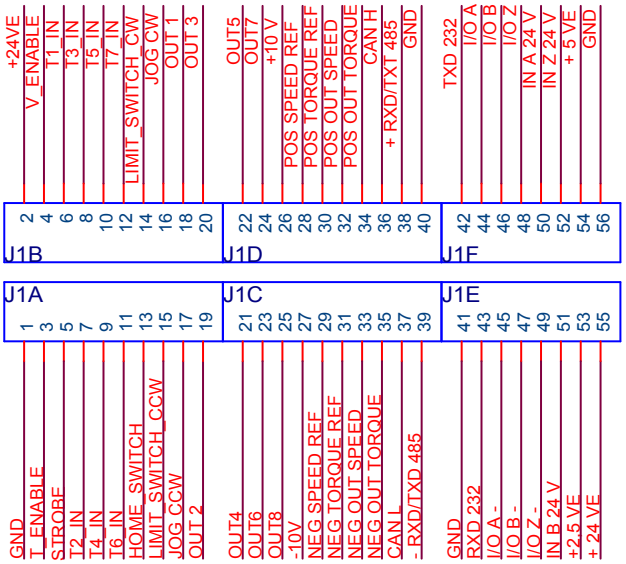


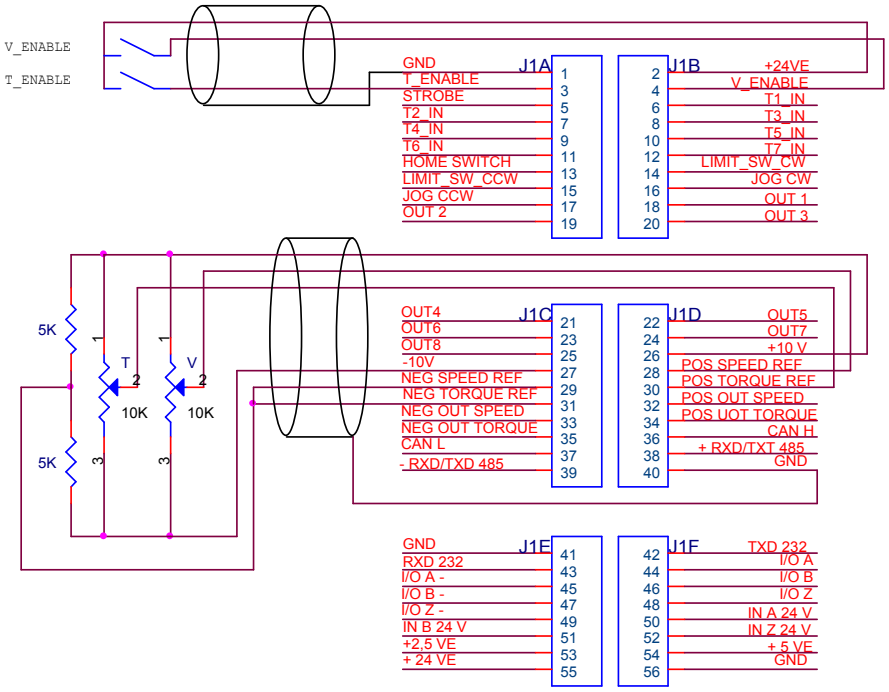
fig. 8

ATTENTION!

All signal connections must be done using screened cables with the screening connected to one of the terminals 1 / 40 / 41 / 56 (0VE). The signal cables must be laid separately from the power ones.

PIN No.	NAME	TYPE	VALUE	FUNCTION
1/40/41/56	GND	O	0Vdc	External signals ground
2/55	+24 VE	I/O	+24Vdc 500mA	24 Vdc output for enables or input for logic backup supply
3	T_ENABLE	I	+ 24 Vdc 5 mA	Torque enable input
4	V_ENABLE			Speed enable input
5	STROBE			Motion profile recall strobe input
6/7/8/9/10/11/12	T… IN			Inputs for motion profile selection
13	HOME SWITCH			Position reset limit switch input
14 / 15	LIMIT SWITCH CW / CCW			Limit switch input clockwise/counter clockwise direction
16 / 17	JOG CW / CCW			JOG command input clockwise/counter clockwise direction
18	OUT 1	O	+ 24 Vdc 80 mA	Protection triggered indication output (Fault)
19	OUT 2			I^2T triggered indication output
20	OUT 3			Limit switch tripped indication output
21	OUT 4			Drive enabled indication output
22	OUT 5			Target position reached indication output
23	OUT 6			Target speed reached indication output
24	OUT 7			Homing done indication output
25	OUT 8			Sync indication output
26	+ 10 V	O	+10 Vdc 10 mA	External potentiometers positive supply
27	- 10 V		-10 Vdc 10 mA	External potentiometers negative supply
28	POS SPEED REF	I	± 10 V	Positive speed reference analogue input
29	NEG SPEED REF			Negative speed reference analogue input
30	POS TORQUE REF			Positive torque reference analogue input
31	NEG TORQUE REF			Negative torque reference analogue input
32	POS OUT SPEED	O	± 10 V	Positive monitor speed output
33	NEG OUT SPEED			Negative monitor speed output
34	POS OUT TORQUE			Positive monitor torque output
35	NEG OUT TORQUE			Negative monitor torque output
36	CAN H	I/O		Can bus H (dominant high)
37	CAN L			Can bus L (dominant low)
38	+RXD/TXD485			Input / output not reversed serial 485
39	-RXD/TXD485			Input / output reversed serial 485
42	TXD232	O		TX RS232 serial output
43	RXD232	I		RX RS232 serial input
44	I/O A	I/O	5 Vdc line driver	Master encoder input (A / Dir) or simulated encoder output channel A
45	I/O A-			Master encoder input or simulated encoder output channel A reversed
46	I/O B			Master encoder input (B/ Imp) or simulated encoder output channel B
47	I/O B-			Master encoder input or simulated encoder output channel B reversed
48	I/O Z			Master encoder input or simulated encoder output channel Z
49	I/O Z-			Master encoder input or simulated encoder output channel Z reversed
50	IN A 24V	I	24 Vdc	Master encoder input channel A or direction
51	IN B 24V			Master encoder input channel B or pulse
52	IN Z 24V			Master encoder input channel Z
53	+2,5 VE	O	2,5 Vdc 10 mA	2.5 V reference output
54	+5 VE	O	5 Vdc 200 mA	5 Vdc output to supply encoder

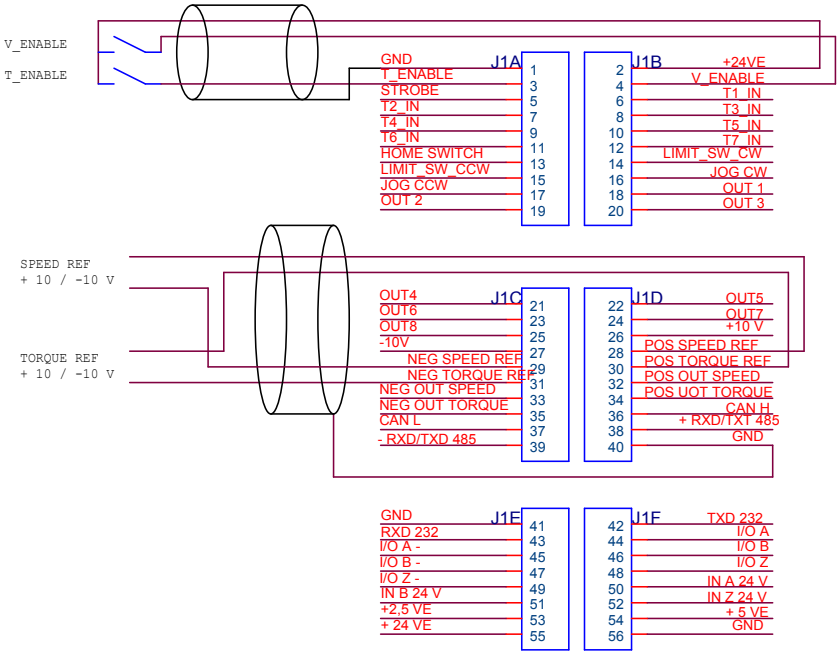
4.5.1 - ANALOGUE SPEED REFERENCES/TORQUE WITH POTENTIOMETERS CONNECTION



J1	SIGNAL	VALUE
1 / 40	GND	0V
3	T_ENABLE	0 / 24 Vdc 5 mA
4	V_ENABLE	
2	24VE	24Vdc 500 mA
26	+10V	10V 10mA
27	-10V	-10V 10mA
28	POS SPEED REF	±10V
29	NEG SPEED REF	±10V
30	POS TORQUE REF	±10V
31	NEG TORQUE REF	±10V

fig. 9

4.5.2 - ANALOGUE SPEED REFERENCES/TORQUE WITH DIFFERENTIAL INPUT CONNECTION



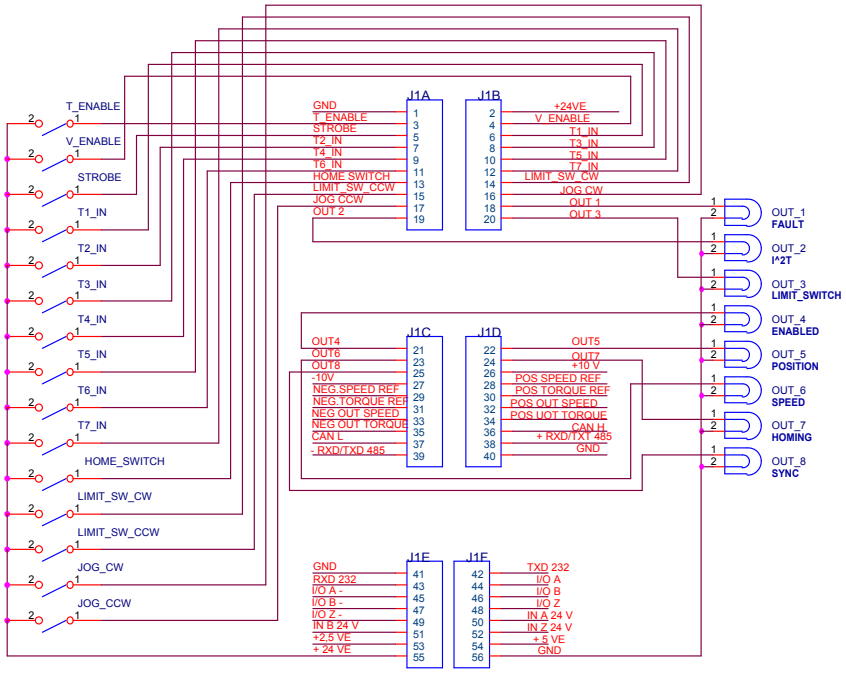
J1	SIGNAL	VALUE
1/40	GND	0V
3	T_ENABLE	0 / 24 Vdc 5 mA
4	V_ENABLE	
2	24VE	24Vdc 500 mA
28	POS SPEED REF	±10V
29	NEG SPEED REF	±10V
30	POS TORQUE REF	±10V
31	NEG TORQUE REF	±10V

fig. 10

ATTENTION!

Use screened cable with screening connected to GND only on the drive side. Separate signal cables from power cables

4.5.3 - 128 MOTION PROFILE SELECTION CONNECTION



J1	SIGNAL	VALUE
2	24VE	24 Vdc 500mA
3	T_ENABLE	0 / 24 Vdc 5 mA
4	V_ENABLE	
5	STROBE	
6	T1_IN	
7	T2_IN	
8	T3_IN	
9	T4_IN	
10	T5_IN	
11	T6_IN	
12	T7_IN	
13	HOME_SWITC	
14	LIMIT_SWITCH_CW	
15	LIMIT_SWITCH_CCW	0 / 24 Vdc 5mA
16	JOG_CW	
17	JOG_CCW	
18	0UT_1	0 / 24 Vdc 80 mA
19	OUT_2	
20	OUT_3	
21	OUT_4	
22	OUT_5	
23	OUT_6	
24	OUT_7	
25	OUT_8	
56	GND	0 Vdc

fig. 11

EXECUTING A PROFILE FROM DIGITAL INPUTS

To enable selection of the 128 profiles via digital inputs set F07=0 and F10=4.

1. Enable the drive by closing the T_Enable and V_Enable inputs.
2. Select the profile to execute by means of the binary combination of the T1_IN, T2_IN, T3_IN, T4_IN, T5_IN, T6_IN, T7_IN inputs. Example: profile number 75 decimal equal to 4b hex corresponding to 1001011 binary so the inputs combination will be T1_IN=1, T2_IN=1, T3_IN=0, T4_IN=1, T5_IN=0, T6_IN=0, T7_IN=1.
3. Wait at least 5 ms after selecting the profile and then close the STROBE input to execute the profile selected.
4. If wanted select another profile via the Tx_IN inputs. Reopen the STROBE contact.
5. Wait at least 5 ms after selecting the profile and then close the STROBE input to execute the new profile selected.

DESCRIPTION OF THE DIGITAL OUTPUTS

OUT_1. FAULT signals triggering of a protection inside the Drivert
OUT_2. I^2T signals that rated current has been exceeded before the OL_In protection triggered
OUT_3. LIMIT_SWITCH signals tripping of the limit switches connected to the LIMIT_SWITCH CW and CCW inputs
OUT_4. ENABLED signals when the drive is enabled and the motor live
OUT_5. POSITION signals, in the case of a position control, target position is reached
OUT_6. SPEED signals target speed is reached
OUT_7. HOMING signals the drive has finished the Homing phase
OUT_8. SYNC the output is activated in encoder tracking control when synchronism is lost

ATTENTION!
Use screened cable with screening connected to GND only on the drive side. Separate signal cables from power cables

4.5.4 – CONNECTION FOR MASTER ENCODER TRACKING OR PULSE/DIRECTION COMMAND

ENCODER TRACKING 5VDC LINE DRIVER

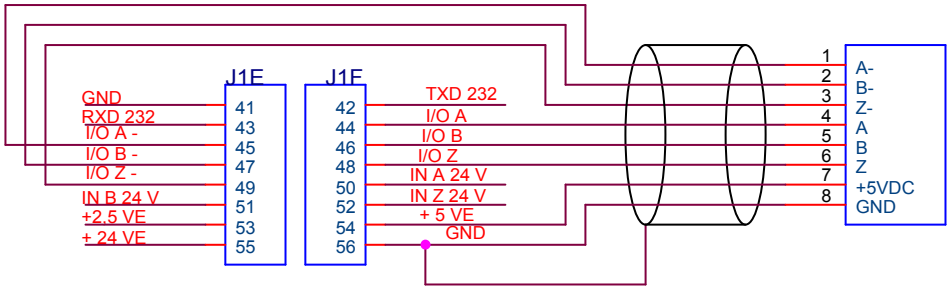


fig. 12

ENCODER TRACKING 5VDC WITHOUT COMPLEMENTARY CHANNELS

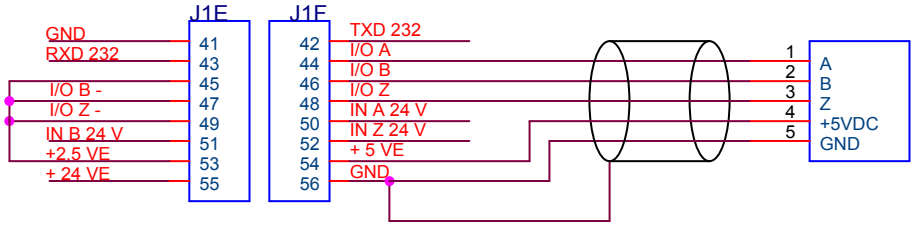


fig. 13

ENCODER TRACKING 24VDC PUSH/PULL

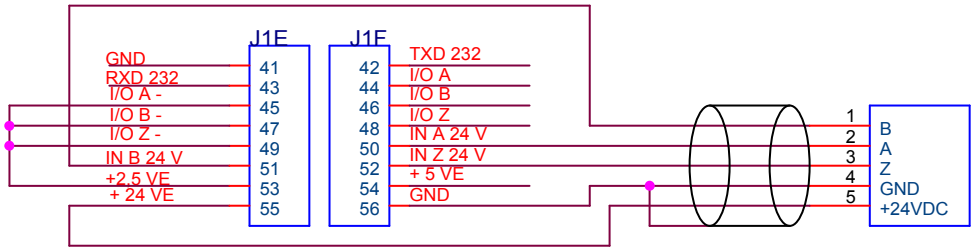


fig. 14

PULSE/DIRECTION COMMAND AT 5V OR 24V

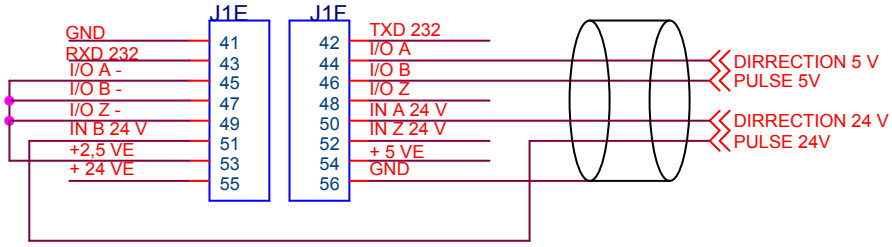


fig. 15

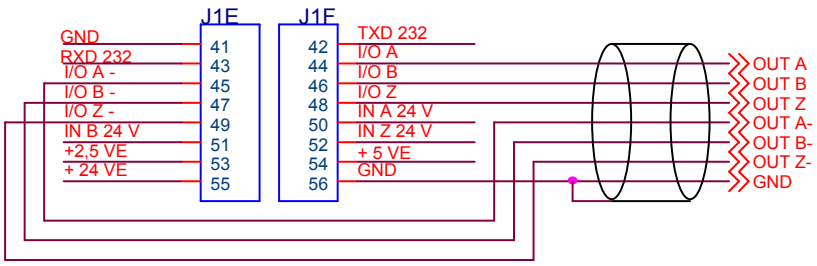
J1	SIGNAL	VALUE
44	I/O A	5 V RS422
45	I/O A-	5 V RS422
46	I/O B	5 V RS422
47	I/O B-	5 V RS422
48	I/O Z	5 V RS422
49	I/O Z-	5 V RS422
50	IN A 24V	24V

J1	SIGNAL	VALUE
51	IN B 24V	24V
52	IN Z 24V	24V
53	+2,5 VE	2,5 V 10 mA
54	+5 VE	5 VDC 200 mA
55	+24 VE	24 VDC 500 mA
56	GND	0 VDC

ATTENTION!

Use screened cable with screening connected to GND only on the drive side. Separate signal cables from power cables

4.5.5 - SIMULATED ENCODER OUTPUT 5V LINE DRIVER CONNECTION 1-1024 PULSES PER REVOLUTION



J1	SIGNAL	VALUE
44	I/O A	5 V RS422
45	I/O A-	5 V RS422
46	I/O B	5 V RS422
47	I/O B-	5 V RS422
48	I/O Z	5 V RS422
49	I/O Z-	5 V RS422
56	GND	0 VDC

fig. 16

With whatever type of control is set, except for master encoder tracking or pulse/direction, a simulated encoder output is available with resolution programmable from 1 to 1024 pulses per revolution (see F15) which means both motor position and speed can be monitored. This output can be used as master encoder for a second Drivert drive.

NOTE: *Output Z and Z- correspond to resolver zero with a resolution of one pulse per revolution; available only at reduced speed, no higher than 100 rpm.*

ATTENTION!
Use screened cable with screening connected to GND only on the drive side. Separate signal cables from power cables

5 - COMMISSIONING

5.1 – PRELIMINARY CHECKS

1) DRIVE

a- Supply voltage : 230 Vac ± 10% 50/60 Hz

2) MOTOR

a- Sinusoidal EMF
b- Nominal supply voltage: 230 Vac Max
c- Rated current: 6A Max
d- Peak-point current: 12A Max
e- Rated speed: 6000 rpm Max
f- Number of pole pairs: 1/ 2 / 3 / 4
g- PTC temperature sensor or NC contact
h- Resolver 2 poles, 10Vac, 10 Khz, transformation ratio 0.5
i- NC brake (normally closed) 24 Vdc 0.5A Max

5.2 - CONNECTIONS

For commissioning the Drivert's motor, both the resolver and supply have to be connected as described in Chapter 4.

5.3 – SETTING MOTOR PARAMETERS

Before timing the motor the value corresponding to the motor connected has to be set in function F 41:

	BS 80/100	BS 80/50	BS 55/100	BS 55/50	BS 45/70	BS 45/35	BS 35/60	BS 35/30
F 41	0	1	2	3	4	5	6	7

By changing function F41 the control parameter values are updated according to the following table.

F 23	4900	2660	1770	1000	750	510	400	220
F 24	12000	8000	6000	4000	3000	2000	1500	1000
F 25	1	1	1	1	1	1	1	1
F 26	100	150	100	150	100	100	100	100
F 27	150	200	200	200	100	100	50	100
F 28	10000	10000	10000	3000	6000	6000	10000	10000
F 29	300	300	200	100	250	250	100	250
F 30	4000	4000	4000	1000	1000	1000	500	500
F 31	200	50	150	140	300	400	250	400
F 32	60	70	60	60	70	70	60	70
F 33	10000	10000	4000	5000	7000	10000	5000	10000
F 34	100	150	200	150	100	200	120	150

NOTE: This setting is ok when the motor runs at no load without inertia; depending on the load applied to the motor, the position and speed ring values need changing to achieve stable and reactive operation.

5.4 - TIMING

The number of motor poles, phase angle between motor and resolver as well as motor rotation direction can be set automatically by means of the timing procedure. **This procedure must be done the first time the drive is started, with the motor shaft free to turn with no friction or inertia.**

1. Turn the drive off
2. Press the SET key and keep in pressed
3. Power the drive
4. Release the SET key after the “RESET” and “SETUP” indication
5. The motor will turn a few times
6. If no failure signals occur, timing is complete when the message “00000” appears; the values found with this procedure are automatically saved in the EEPROM.

NOTE: *Speed control is enabled programming the DEFAULT parameters. With this configuration speed start and variation are both controlled via the keyboard. Rotation enable is subordinate to closing of the T_Enable and V_Enable contacts.*

6 – TABLE OF PROGRAMMABLE FUNCTIONS

A series of functions defining parameters and data appertaining to the motor to be started can be modified by means of the following programming.

Programming the functions.

1. Press and release immediately the FUNC key; F000→199 appears on the display.
2. Press + or – to choose the function to change.
3. Press SET to visually display the value of the function selected; each time the SET key is pressed the blinking number is scrolled which can be changed with + and -.
4. If you want to change another function, press FUNC and repeat the steps from point 2.
5. Save the changed functions with SAVE.

***NOTE**: After 12 sec of doing nothing, the drive exits the functions menu.*

Programming can be exited at any time in the following ways:

1. Do not press any key for at least 12 sec; in this case the changed values are stored in RAM.
2. Press SAVE; in this case the values changed are saved in Eeprom.
3. Press RESET; in this case the values changed are substituted by those already in the Eeprom. (The RESET key is disabled with F07=2 or 3)

***NOTE**: the drive works utilising the data stored in the RAM memory.*

***NOTE:** the functions can be changed only if the F 189 function contains the value 54321. The DEFAULT values can be recalled by pressing RESET when switching the Drivert on.*

Function	Description	Unit	Range	Default
F 00	Reference speed	Rpm	-6000 ÷ 6000	4000
	Used as the variable reference speed with keys + and – or fixed. See function 9.			

Function	Description	Unit	Range	Default
F 01	Speed reference analogue offset	mV	-9999 ÷ 10000	0
	Utilised to cancel a speed offset that causes the motor to rotate with an external analogue reference of 0V.			

Function	Description	Unit	Range	Default
F 02	Jog speed	Rpm	1 ÷ 6000	100
	Reference for Jog speed used with the JOG CW/CCW inputs. It is subordinate to closing of the T_Enable contact and prevails over all the other commands. It allows the motor to be moved in both rotation directions			

Function	Description	Unit	Range	Default
F 03	Maximum speed	Rpm	1 ÷ 6000	4000
	Limits maximum motor speed *NOTE: If the speed reference analogue is enabled, maximum reference corresponds to the maximum speed value.*			

Function	Description	Unit	Range	Default
F 04	Acceleration ramp	ms	5 ÷ 10000	100
	Sets the time necessary to go from 0 to maximum speed set in F03.			

Function	Description	Unit	Range	Default
F 05	Deceleration ramp	ms	5 ÷ 10000	100
	Sets the time necessary to go from maximum speed set in F03 to 0.			

Function	Description	Unit	Range	Default
F 06	Jog acceleration/deceleration ramp and reaching the limit switch	ms	5 ÷ 10000	100
	Sets the acceleration and deceleration ramp in ms with intervention of the JOG command or deceleration time with tripping of the CW and CCW limit switches.			

Function	Description	Unit	Range	Default
F 07	Commands origin		0-1-2 -3	1
	0) Command via digital inputs and for selection of the motion tables 1) START/STOP command via the keyboard, for speed control only. *2)* Canopen command via the CW. *3)* Command via the RS232/485 serial connection.			

Function	Description	Unit	Range	Default
F 08	Reversing rotation direction		0-1	0
	0) Standard rotation direction, clockwise rotation with positive reference or position increment 1) Reversed rotation direction, counter clockwise rotation with positive reference or position increment			

Function	Description	Unit	Range	Default
F 09	Type of speed reference		0-1-2	2
	0) Analogue reference ±10V 1) Reference set in F00. 2) Reference set in F00, modifiable with keys + and – on the keyboard.			

Function	Description	Unit	Range	Default
F 10	Type of control		0-1-2-3-4	1
	0) Torque control 1) Speed control 2) Speed and position tracking via external master encoder signal 3) Speed and position tracking via external pulse/direction signal 4) Enable motion profiles selected via digital inputs			

Function	Description	Unit	Range	Default
F 11	Display		0-1-2-3-4-5	0
	0) Rotation speed in Rpm. 1) Motor input in Ampere. 2) Motor voltage in Volt. 3) Internal Drivert temperature in Centigrade. 4) Instant position in position units. 5) Profile selected.			

Function	Description	Unit	Range	Default
F 12	Master encoder tracking ratio. Resolver unit / (master encoder pulses x 4). Resolver unit = 4096 *NOTE: This function contains a 10-digit number, 3 whole and 7 decimals, utilise the SET key to scroll it.*		-200.0000000 ÷ +200.0000000	001.0000000
	Establishes a ratio between motor and MASTER encoder revolutions. 0) e.g.: if the motor has to make a complete revolution for each revolution of the encoder (512 pulses) the ratio is (1 revolution x 4096 resolver units) / (1 revolution x 512 Encoder Pulses x 4) = 2, so F12 has to be set at 002.0000000 1) e.g.: if the motor has to make 0.1 revolution (i = 10) for each revolution of the encoder (2048 pulses), the ratio is (0.1 revolution x 4096 resolver units) / (1 revolution x 2048 encoder pulses x 4) = 0.05, so F12 has to be set at 000.0500000			

Function	Description	Unit	Range	Default
F 13 F 14	Position factor numerator Position factor denominator Position factor = F13/F14 *NOTE: This function contains a 10-digit number, use the SET key to scroll it.*		0 ÷ 2147483647 0 ÷ 2147483647	0409600000 0000100000 Factor = 4096
	Establishes the ratio between the resolver units (4096) and displacement so the position values can be expressed in the unit of measure preferred. 0) e.g.: MOTOR APPLIED DIRECTLY TO A RECIRCULATING-BALL SCREW WITH A 10 mm PITCH. Each revolution of the motor corresponds to a forward motion of 10 mm so if we want to set the values in mm, the position factor is equal to 4096/10. The values to set are: F13=0000004096 F14=0000000010 1) e.g.: MOTOR APPLIED TO A REDUCTION UNIT i=25 WITH A ROTATING TABLE POSITIONED AT AN ANGLE, EXPRESSED IN DEGREES. Knowing that to have a 360° displacement of the table the reduction unit has to make 1 complete revolution equal to 25 motor revolutions, the position factor is (resolver pulses/angular displacement) = (4096 X 25) / 360. The values to set are: F13=0000102400 F14=0000000360 2) e.g.: MOTOR APPLIED TO A REDUCTION UNIT i = 5 CONNECTED TO A TOOTHED PINION (MODULE M = 1.5 AND NUMBER OF TEETH Z=18) AND RELATIVE RACK FOR POSITIONING EXPRESSED IN mm. Knowing that 5 revolutions of the motor, equivalent to 1 revolution of the pinion, leads to a linear displacement given by M x Z x π equal to 1.5 x 18 x π = 84,82300165 mm, the position factor is (resolver unit/displacement in mm) = (5 x 4096) / 8,482300165 The values to set are: F13=2048000000 F14=0008482300			

Function	Description	Unit	Range	Default
F 15	Simulated encoder pulses		1 ÷ 1024	1024
	Defines the resolution of the simulated encoder in output referring to 1 motor revolution.			

Function	Description	Unit	Range	Default
F 16	Analogue speed output scale	Rpm	0 ÷ 6000	6000
	Defines the speed corresponding to the maximum value (10V) of the analogue Out_Speed output			

Function	Description	Unit	Range	Default
F 17	Analogue torque output scale	mA	100 ÷ 12000	12000
	Defines the current corresponding to the maximum value (10V) of the analogue Out_Torque output			

Function	Description	Unit	Range	Default
F 18	Device number		1 ÷ 127	32
	Used to identify the drive in the case of RS485 serial communication with several units connected in parallel (Max 32 devices).			

Function	Description	Unit	Range		Default
F 19	Serial communication speed	Baud	"RF" serial connection	Display	19200
			0	4800	
			1	9600	
			2	19200	
			3	38400	
			4	57600	
	Defines the RS232/RS 485 serial communication speed. The change of communication speed is activated by turning the drive off and then on.				

Function	Description	Unit	Range	Default
F 20	RS232 / RS485 serial connection type		0 ÷ 1	1
	Defines the type of serial connection used: 0) RS 485 1) RS 232			

Function	Description	Unit	Range		Default
F 21	Canopen field communication bus speed	Kbit/s	"RF" serial connection	Display	125
			0	10	
			1	20	
			2	50	
			3	100	
			4	125	
			5	250	
			6	400	
			7	500	
			8	800	
			9	1000	
	Defines the Canopen field communication bus speed.				

Function	Description	Unit	Range	Default
F 22	Canopen node ID		1 ÷ 127	32
	Used to identify the drive in the case of communication on the Canopen field bus			

Function	Description	Unit	Range	Default
F 23	Motor rated current	mA	100 ÷ 6000	4900
	Defines the motor's rated current the drive can supply for an unspecified time.			

Function	Description	Unit	Range	Default
F 24	Motor peak-point current	mA	100 ÷ 12000	12000
	Defines the peak current the drive can supply to the motor for a maximum time settable in F25.			

Function	Description	Unit	Range	Default
F 25	Peak-point current time constant	s	0 ÷ 5	1
	Defines the maximum time in which the drive supplies the motor with a current value higher than the nominal value and beyond which the overload protection triggers with the indication OL_IN.			

Function	Description	Unit	Range	Default
F 26	Proportional speed error factor		10 - 1000	100

Function	Description	Unit	Range	Default
F 27	Integral speed error factor		10 – 1000	150

Function	Description	Unit	Range	Default
F 28	Proportional position error factor		10 – 30000	10000

Function	Description	Unit	Range	Default
F 29	Derivative position error factor		0 – 1000	300

Function	Description	Unit	Range	Default
F 30	Integral position error factor		0 – 4000	4000

Function	Description	Unit	Range	Default
F 31	Mechanical time constant	ms	1 – 3000	200

Function	Description	Unit	Range	Default
F 32	Acceleration compensation		0 – 500	60

Function	Description	Unit	Range	Default
F 33	Integral current control factor		10 – 20000	10000

Function	Description	Unit	Range	Default
F 34	Proportional current control factor		1 – 500	100

Function	Description	Unit	Range	Default
F 35	Homing type		1 ÷ 35	1
	Defines the homing type used to reset the position. See Chap. 8.6.			

Function	Description	Unit	Range	Default
F 36	Switch search speed	Rpm	1 ÷ 6000	100
	Speed used to search for the switch during the homing procedure.			

Function	Description	Unit	Range	Default
F 37	Resolver zero search speed	Rpm	1 ÷ 1000	10
	Speed used to search for the resolver zero during the homing procedure.			

Function	Description	Unit	Range	Default
F 38	Homing Acceleration/Deceleration	ms	5 ÷ 10000	100
	Acceleration and deceleration ramp during the homing procedure.			

Function	Description	Unit	Range	Default
F 39	Home Offset *NOTE: This function contains a 10-digit number with mobile comma, use the SET key to scroll it.*		Variable depending on the position factor	0
	Used in the case of position control to associate a value to the home position in the customer's position unit. When read or written via serial connection the value is expressed in resolver units (4096 x revolution).			

Function	Description	Unit	Range	Default
F 40	Profiles page		0 – 1 – 2	0
	Used to choose 3 possible pages of 128 movement profiles.			

Function	Description	Unit	Range	Default
F 41	Motor type		0 – BS80-100 1 – BS80-50 2 – BS55-100 3 – BS55-50 4 – BS45-70 5 – BS45-35 6 – BS35-60 7 – BS35-30 8 – BS35-30	0
	Used to recall the optimal values of the control parameters according to the motor applied. The functions that are modified are: F23/24/25/26/27/28/29/30/31/32/33/34.			

Function	Description	Unit	Range	Default
F 42	Error code		See Chap.9	0
	Contains the code of the last safety device triggered. See Chap.9			

Function	Description	Unit	Range	Default
F43 ÷ F 56	Not used			

Function	Description	Unit	Range	Default
F57 ÷ F187	Dictionary of Canopen objects			
	Functions F57 through F187 contain the Canopen objects dictionary which can be visually displayed but a change is only allowed by means of the SDO protocol via the Canopen bus. See Dictionary of the objects, Chap. 10.9.			

Function	Description	Unit	Range	Default
F 188	Not used			

Function	Description	Unit	Range	Default
F 189	Function change block		0 ÷ 65535	54321
	If set at a value different from 54321 it prevents function values from being changed.			

Function	Description	Unit	Range	Default
F 190	Not used			

Function	Description	Unit	Range	Default
F 191	Initial timing		0 ÷ 1	1
	Written at 1 if motor timing has been carried out (Cannot be changed)			

Function	Description	Unit	Range	Default
F 192	Cyclic order		1 o 65535	
	Visually displays the cyclic order of the phases obtained during timing (Cannot be changed)			

Function	Description	Unit	Range	Default
F 193 / F 194	Resolver zero		0 ÷ 65535	
	Visually displays the resolver's offset angle obtained during timing (Cannot be changed)			

Function	Description	Unit	Range	Default
F 195	Number of motor pole pairs		1 ÷ 4	
	Visually displays the number of motor pole pairs obtained during timing (Cannot be changed)			

Function	Description	Unit	Range	Default
F 196	Current reading offset Lem 1		25000 ÷ 40000	
	Visually displays the analogue input offset of the Lem 1 current reading obtained during timing (Cannot be changed)			

Function	Description	Unit	Range	Default
F 197	Current reading offset Lem 2		25000 ÷ 40000	
	Visually displays the analogue input offset of the Lem 2 current reading obtained during timing (Cannot be changed)			

Function	Description	Unit	Range	Default
F 198	Test voltage		100 ÷ 270	
	Visually displays the test voltage utilised during timing (Cannot be changed)			

Function	Description	Unit	Range	Default
F 199	Not used			

7 - 128 PROGRAMMABLE MOTION PROFILES TABLE

Each one of the 128 motion profiles can be defined individually with type of motion, acceleration, speed, target, deceleration and master encoder tracking ratio following the programming steps described below. The programmed profiles can be controlled via digital inputs, Canopen field bus or RS232/485 serial connection (see Chap. 4.5.3 and Chap. 8.5).

Profile programming.
To access profile parameter change press the FUNC key for longer than 1 sec. Choose the parameter of the profile to change with the FUNC key and the number of the profile with keys + and -. Press SET to visually display the value of the parameter selected; each time you press the SET key the blinking digit scrolls which can be changed with + and - ; to go to the next parameter press FUNC. Once the "Res" parameter has been set, by pressing FUNC all modified data are saved automatically.

NOTE: *The number of the profile is visually displayed in hexadecimal from 0 to 0x7F corresponding to a range that goes from 0 to 128 in decimals. The functions may only be changed if function F189 contains the value 54321. The DEFAULT values can be recalled by pressing the RESET key when switching the Drivert on.*

Parameter	Description	Unit	Range	Default
Tip(00÷0x7F)	Type of motion		0 ÷ 8	2
	0) Homing 1) Speed control 2) Absolute position control 3) Relative position control 4) Absolute position control with search of the shortest path in 360° 5) Torque control 6) Linear master encoder tracking with inputs A and B in quadrature 7) Linear master encoder tracking with pulse/direction inputs.			

Parameter	Description	Unit	Range	Default
Acc(00÷0x7F)	Acceleration ramp/current	ms / mA	-9999 ÷ 10000	500
	Sets the acceleration time to go from 0 to maximum speed for the selected motion profile. In the case of torque control it defines current value and rotation direction.			

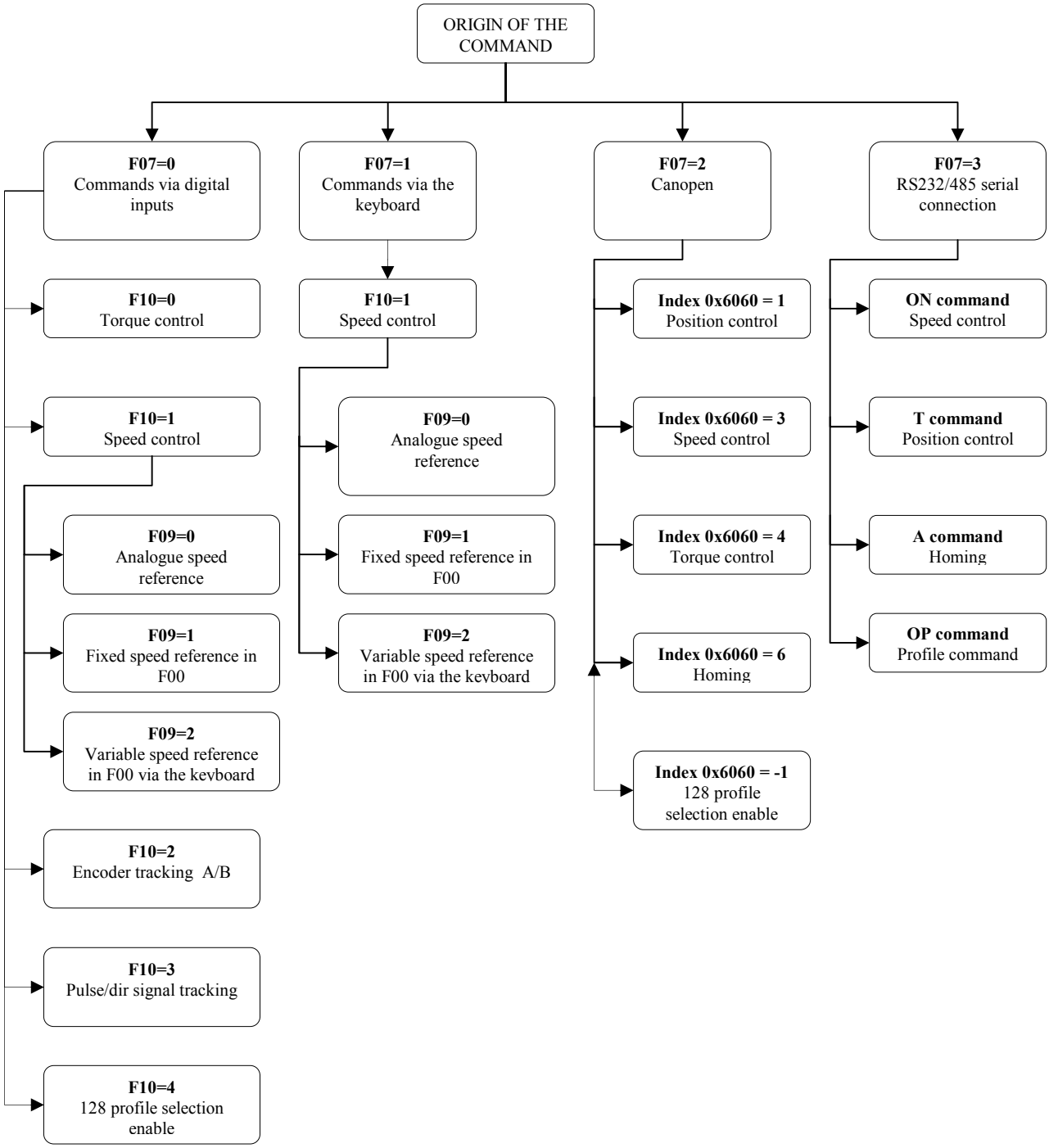
Parameter	Description	Unit	Range	Default
Vel(00÷0x7F)	Reference speed	Rpm	-6000 ÷ 6000	4000
	Sets the reference speed for the motion profile selected in the target table.			

Parameter	Description	Unit	Range	Default
Dec(00÷0x7F)	Deceleration ramp	ms	5 ÷ 10000	500
	Sets the deceleration time to go from maximum speed to 0 for the selected motion profile.			

Parameter	Description	Unit	Range	Default
TrA(00÷0x7F)	Target position *NOTE: This function contains a 10-digit number with moveable comma, use the SET key to scroll it.* *NOTE: With rotating displacements and search for the shortest path (Tip=4) the values must be expressed in degrees and the maximum value can be 360°.*		Variable depending on the position factor	No. profile X 0.5
	Sets the position for the selected motion profile.			

Parameter	Description	Unit	Range	Default
Res(00÷0x7F)	Master encoder tracking ratio. Resolver unit/ (master encoder pulses x 4). Resolver unit = 4096 *NOTE: This function contains a 10-digit number, 3 whole and 7 decimals, utilise the SET key to scroll it.*		-200.0000000 ÷ +200.0000000	001.0000000
	Establishes the ratio between motor revolutions and those of the MASTER encoder.			

8 – FUNCTIONING MODES



8.1 – SPEED CONTROL WITH START COMMANDS VIA THE KEYBOARD

With this configuration the motor can be controlled when running, using the keyboard to start and stop it.
The following functions have to be set in order to use this type of control:

1. F07=1 (Command via the keyboard)
2. F10=1 (Speed control)
3. F09=0 (Speed reference via analogue input), F09=1 (Fixed reference in F00) or F09=2 (Variable reference via the keyboard); maximum speed is limited by function F03.
4. Close the contacts T_Enable and V_Enable to enable the drive.
5. Press the ↺ key to control starting of the motor in the counter clockwise direction or the ↻ key for the clockwise direction with the acceleration ramp adjusted by F04.
6. Speed is adjusted according to the reference chosen with function F09.
7. The motor can be stopped with the deceleration ramp adjusted by F05 pressing STOP or opening the V_Enable contact.
8. Opening of the T_Enable contact during operation causes the uncontrolled stopping of the motor, voltage being immediately cut off to it.

Note: The Limit_Switch inputs are active which cause the motor to stop in ramp, as well as the Jog inputs which cause the motor to run at Jog speed.

8.2 – SPEED CONTROL WITH START COMMANDS VIA DIGITAL INPUTS

With this configuration the motor can be controlled when running, using the digital inputs to start and stop it.
The following functions have to be set in order to use this type of control:

1. F07=0 (Command via digital inputs)
2. F10=1 (Speed control)
3. F09=0 (Speed reference via analogue input), F09=1 (Fixed reference in F00) or F09=2 (Variable reference via the keyboard); maximum speed is limited by function F03.
4. Close the T_Enable contact to enable the drive.
5. Close the V_Enable contact to control motor starting.
6. Speed and rotation direction are adjusted according to the reference chosen with function F09.
7. The motor can be stopped with the deceleration ramp adjusted by F05 opening the V_Enable contact.
8. Opening of the T_Enable contact during operation causes the uncontrolled stopping of the motor, voltage being immediately cut off to it.

NOTE: The Limit_Switch inputs are active which cause the motor to stop in ramp as well as the Jog inputs which cause the motor to run at Jog speed.

8.3 - TORQUE CONTROL WITH MAXIMUM SPEED LIMIT

Motor torque can be controlled with this configuration; the drive supplies the motor with a current value adjusted by the analogue inputs TORQUE_REF, limiting maximum speed.
The following functions have to be set in order to use this type of control:

1. F07=0 (Command via digital inputs)
2. F10=0 (Torque control)
3. In F03 adjust maximum speed the motor must not exceed when torque is higher than stall torque.
4. In F24 adjust maximum current supplied by the drive when the analogue reference is at maximum positive or negative (+10 o –10V).
5. Close the T_Enable contact to enable the drive.
6. Close the V_Enable contact to control motor starting.
7. Torque (current) and rotation direction are adjusted according to the value and analogue reference sign connected to the TORQUE_REF inputs.
8. Open the V_Enable contact to stop the motor, taking torque to zero.
9. Open the V_Enable contact to cut voltage off immediately to the motor.

NOTE: The Limit_Switch inputs are active causing the torque reference to reset. The Jog inputs are not active in this control.

8.4 - ENCODER TRACKING

With this configuration the motor can be controlled that will track, in speed and position, either an encoder type signal (signal A and B in quadrature) or a Pulse/Direction type signal. With this configuration a ratio can be established between the number of encoder revolutions and those the motor has to make. The encoder emulation is disabled with this configuration. The following functions have to be set in order to use this type of control:

1. F07=0 (Command via digital inputs)
2. F10=2 (Tracking A/B signals in quadrature) or F10=3 (Tracking Pulse/Direction signals)
3. In F03 adjust maximum speed, if the encoder to track exceeds the speed permitted in F03 synchronism will be lost but recovered as soon as the reference speed drops (the SYNC output is activated during the synchronism loss phase).
4. Set the tracking ratio between the motor and reference encoder in F12.
5. Close the T_Enable contact to enable the drive in torque and reading of the encoder inputs. The motor cannot turn in this phase but the position reference coming from the encoder is read.
6. Close the V_Enable contact to enable motor rotation. In this case the motor tracks the encoder signal, the only limitation being given by maximum speed (F03). (If the encoder signal is changed between closing of contact T_Enable and closing of V_Enable, the motor executes an acceleration in ramp to regain synchronism with the reference).
7. Opening of the V_Enable contact causes the motor to stop in ramp without losing synchronism (the encoder input continues to be read)
8. Opening of the T_Enable contact causes stopping, voltage is immediately cut off to the motor and synchronism lost (the encoder input is not read and the previous reference is reset).

NOTE: The Limit_Switch inputs are active which cause the motor to stop in ramp as well as the Jog inputs which cause the motor to run at Jog speed. Tripping of the Limit-Switches or Jog commands leads to loss of synchronism between motor and reference encoder.

8.5 - 128 MOTION PROFILE SELECTION

With the Drivert 1000 drive, 128 motion profiles can be stored, controllable by the digital inputs, the RS232/485 serial connections or the Control Word with Canopen field bus. With this configuration we can switch between the different types of motor control described previously or use the same type of control but with different operating parameters (speed, ramps, target or encoder tracking ratio).

8.5.1 – PROFILE TYPE

The profile type specifies the type of motion the motor has to perform; the possible values are:

Type 0. Homing. Sets the axis resetting procedure (homing) in the profile as described in Chap. 8.6.
Type 1. Speed control. Sets a speed control in the profile. The reference is determined by the profile speed value.
Type 2. Absolute position control. Defines an absolute peer-to-peer position control with speed, ramps and target defined in the profile.
Type 3. Relative position control. Defines a relative peer-to-peer position control with speed, ramps and target defined in the profile.
Type 4. Absolute position control with search for the shortest path in 360°.
Type 5. Torque control. Sets a torque control in the profile. Torque reference is defined in mA in the profile acceleration profile.
Type 6. Master encoder tracking with A/B signals in quadrature. Sets an encoder tracking control in the profile with A/B signals in quadrature and the ratio defined in the profile Res parameter.
Type 7. Master encoder tracking with Pulse/Direction signals. Sets an encoder tracking control in the profile with Pulse/Direction signals and the ratio defined in the profile Res parameter.

8.5.2 - PARAMETERS

Speed, acceleration, deceleration, target and encoder tracking ratio values can be defined individually for each of the 128 profiles. See Chap. 7.

8.5.3 – EXECUTION OF A PROFILE VIA DIGITAL INPUTS

To enable selection of the 128 profiles via digital inputs, F07=0 and F10=4 have to be set.

1. Enable the drive, closing the T_Enable and V_Enable inputs.
2. Select the profile to execute by means of the binary combination of the T1_IN, T2_IN, T3_IN, T4_IN, T5_IN, T6_IN, T7_IN inputs. Example: profile number 75 decimal equal to 4b hex corresponds to 1001011 binary so the inputs combination will be T1_IN=1, T2_IN=1, T3_IN=0, T4_IN=1, T5_IN=0, T6_IN=0, T7_IN=1.
3. Wait at least 5 ms after selecting the profile and then close the STROBE input to execute the profile selected.
4. If wanted select another profile via the Tx_IN inputs. Reopen the STROBE contact.
5. Wait at least 5 ms after selecting the profile and then close the STROBE input to execute the profile selected.

8.5.4 – EXECUTION OF A PROFILE VIA SERIAL CONNECTION

To enable selection of the 128 profiles via an RS232/485 serial connection, F07=3 has to be set.

1. Use the “OP” command with the number of the profile to execute. The profile is executed immediately after receiving the telegram.

8.5.5 - EXECUTION OF A PROFILE VIA CANOPEN FIELD BUS

To enable selection of the 128 profiles via Canopen, F07=2 and Mode of operation Index 6060 = -1 have to be set.

1. Take the drive to the OPERATIONAL condition (see protocol NMT Chap. 10.3.3)
2. Take the drive to the OPERATION ENABLED condition (see Control of drive via Canopen Chap. 10.4)
3. Select the number of the profile to execute, writing it in the Control_Word1 Index 2050 object.
4. Enable execution of the profile taking the STROBE bit 4 of the Control Word Index 6040 to 1.
5. Take bit 4 of the Control Word to 0 (New Set-point).

To execute a new profile repeat the steps at points 3, 4 and 5. It is possible to stop a profile by activating bit 8 (Halt) of the Control Word; by taking this bit back to 0 you continue with the profile that was being executed.

8.6 – DESCRIPTION OF THE HOMING FUNCTION

The Homing function is used to reset or refer the axis in the case of position control. The drive searches for the Home position according to the homing type selected.
The Homing function is available with a local command via digital inputs to select the motion profiles, with command via serial connection (RS232/485) and with a Canopen field bus command.

Switch search speed.
With local command: F36
Canopen: Index 6099 Sub1
Sets the speed used for the search of the Home Switch or Limit Switch depending on the Homing type used.

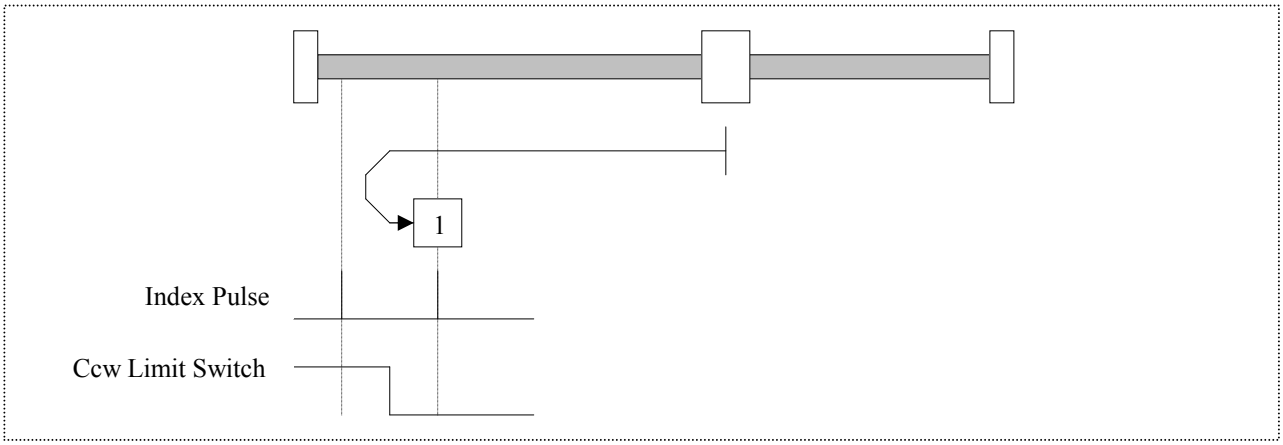
Resolver zero search speed.
With local command :F37
Canopen : Index 6099 Sub2
Sets the speed used to search for the Index Pulse (resolver zero).

Homing Acceleration/Deceleration.
With local command: F38
Canopen: Index 609A
Sets the acceleration and deceleration ramps used during the Homing phase.

Home Offset
With local command: F39
Canopen: Index 607C
Assigns a value to the Home position.

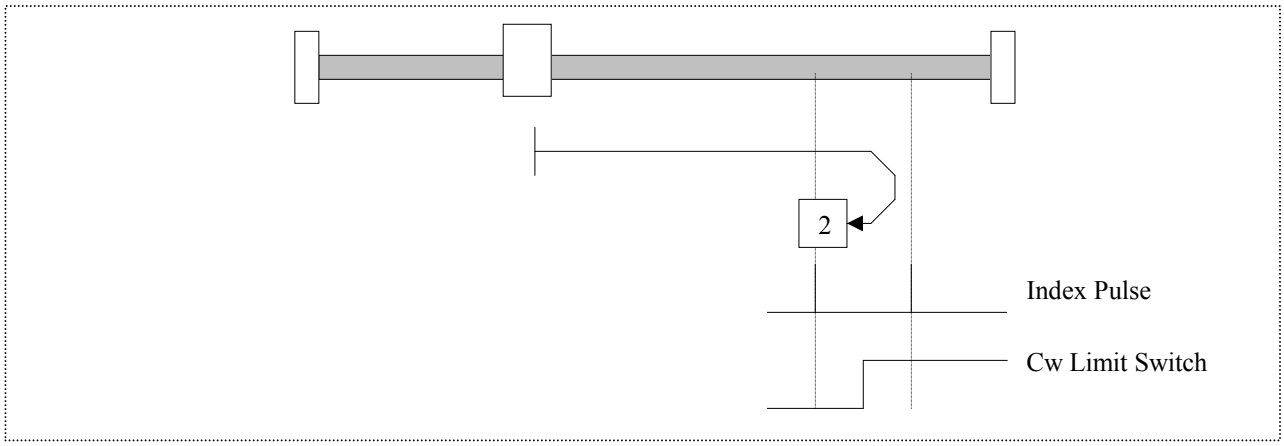
Homing type:
With local command :F35
Canopen : Index 6098
Defines the Homing type used, described in the following diagrams.

Type 1 (F35=1 Index 6098=1): Homing on the counter clockwise Limit Switch and Index Pulse (resolver zero).



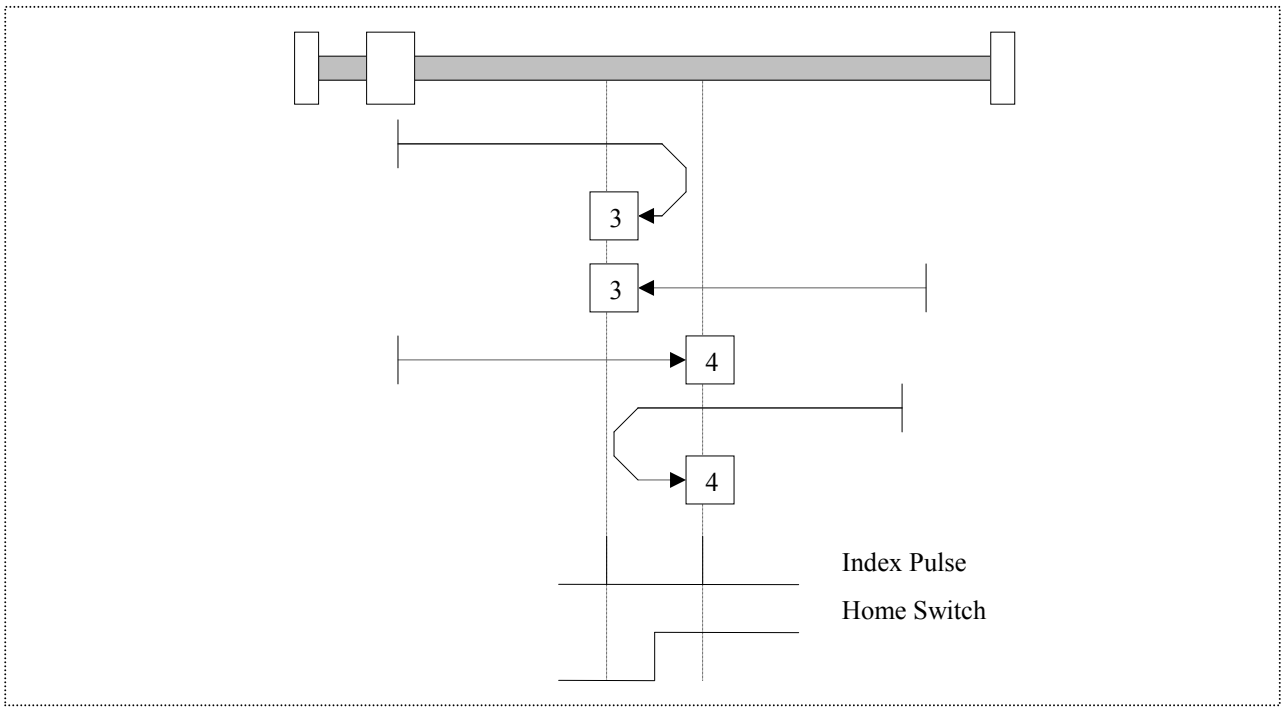
With this Homing type the initial motion direction is counter clockwise, towards the Ccw Limit Switch (counter clockwise) if it is inactive. The reference position (Home position) is on the first Index Pulse (resolver zero) on the right of the counter clockwise Limit Switch when its signal becomes low.

Type 2 (F35=2 Index 6098=2): Homing on the clockwise Limit Switch and Index Pulse (resolver zero).



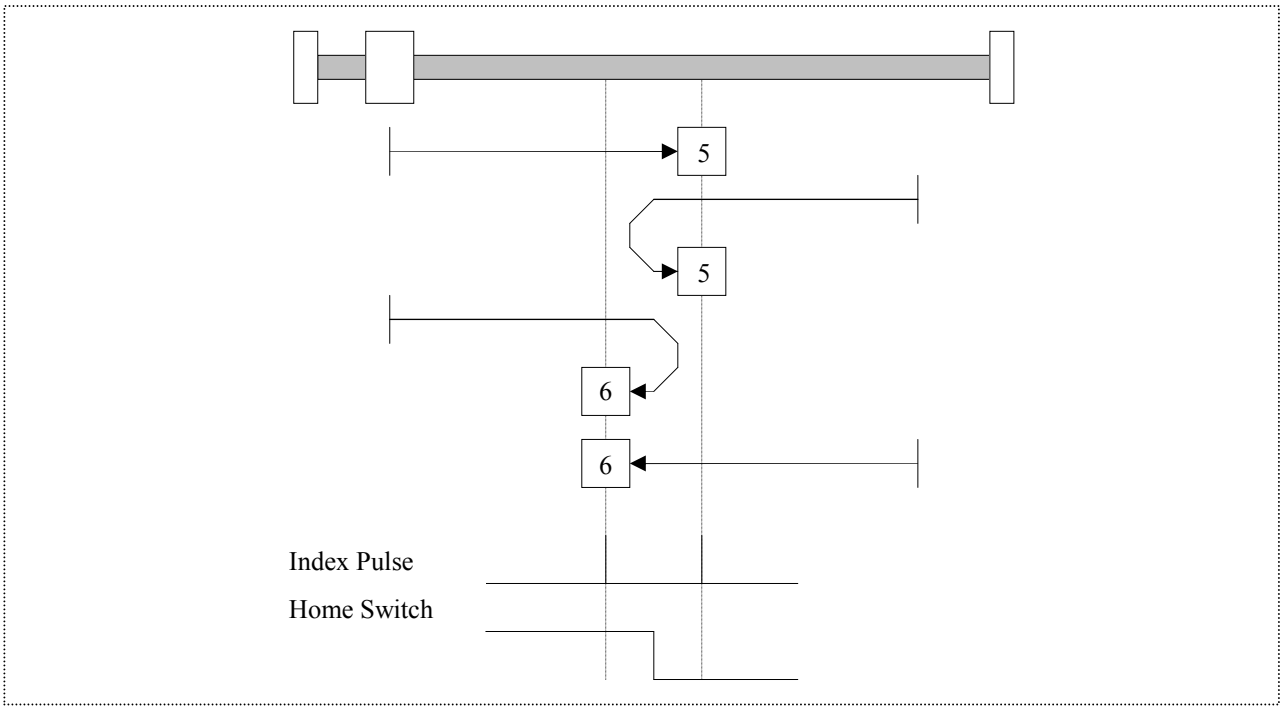
With this Homing type, initial motion direction is clockwise, towards the Cw Limit Switch Cw (clockwise) if it is inactive. The reference position (Home position) is on the first Index Pulse (resolver zero) to the left of the Cw Limit Switch Cw (clockwise) when its signal becomes low.

Types 3 and 4 (F35=3 or 4 Index 6098=3 or 4): Homing on the positive Home Switch and Index Pulse (resolver zero).



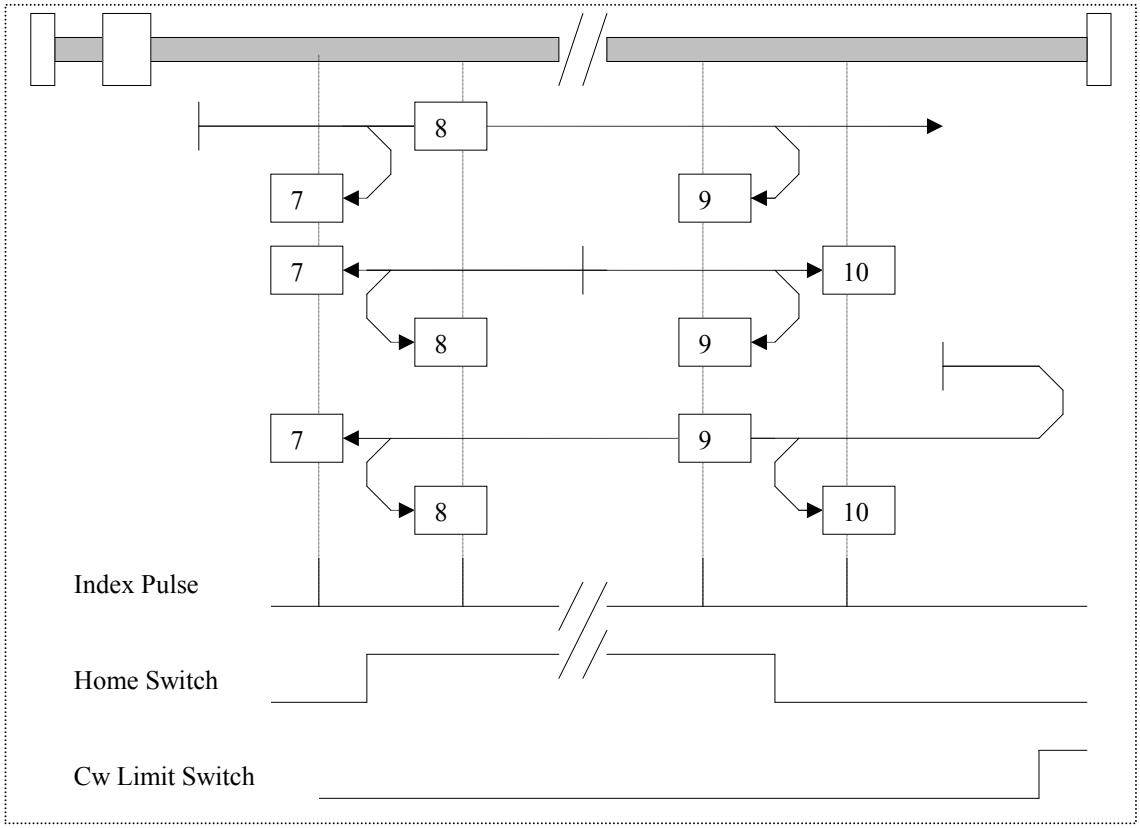
With type 3 and 4 initial motion direction depends on Home Switch status. The reference position (Home position) is on the Index Pulse (resolver zero) to the left (type 4) or right (type 3) of the Home Switch switching point. If the starting position is such that direction reversal is required, the latter occurs after the Home Switch status changes.

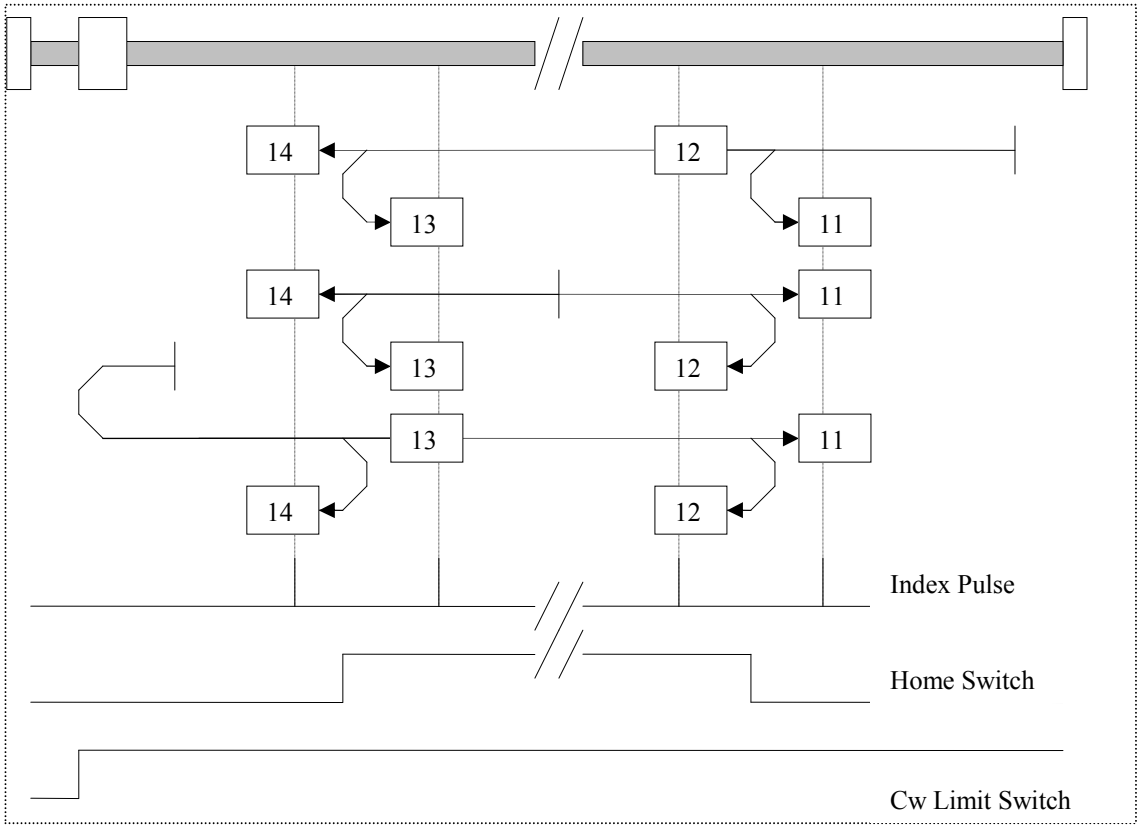
Types 5 and 6 (F35=5 or 6 Index 6098=5 or 6): Homing on the negative Home Switch and Index Pulse (resolver zero).



With type 5 and 6 initial motion direction depends on Home Switch status. The reference position (Home position) is on the Index Pulse (resolver zero) to the left (type 6) or right (type 5) of the Home Switch switching point. If the starting position is such that direction reversal is required, the latter occurs after the Home Switch status changes.

Types 7 to 14 (F35=7-14 Index 6098=7-14): Homing on the Home Switch and Index Pulse (resolver zero).

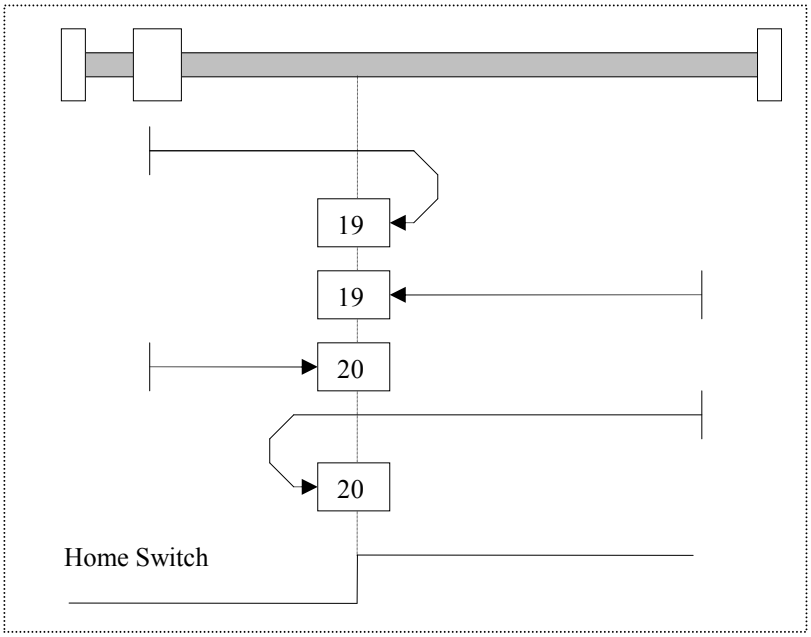




These Homing types use the Home Switch where the signal is high only for a portion of the whole travel. With types 7 to 10, initial motion direction is clockwise while it is counter clockwise if types 11 to 14 are used except for when the Home Switch signal is high at the start of the motion. In this case initial motion direction depends on the edge it is going towards. The reference position (Home position) is on the Index Pulse (resolver zero) to the left or right of the leading or trailing edge of the Home Switch. If the initial direction does not meet the Home Switch the direction is reversed on the Limit Switch.

Types 15 and 16: Reserved

Types 17 to 30 (F35=17-30 Index 6098=17-30): Homing without Index Pulse (resolver zero).

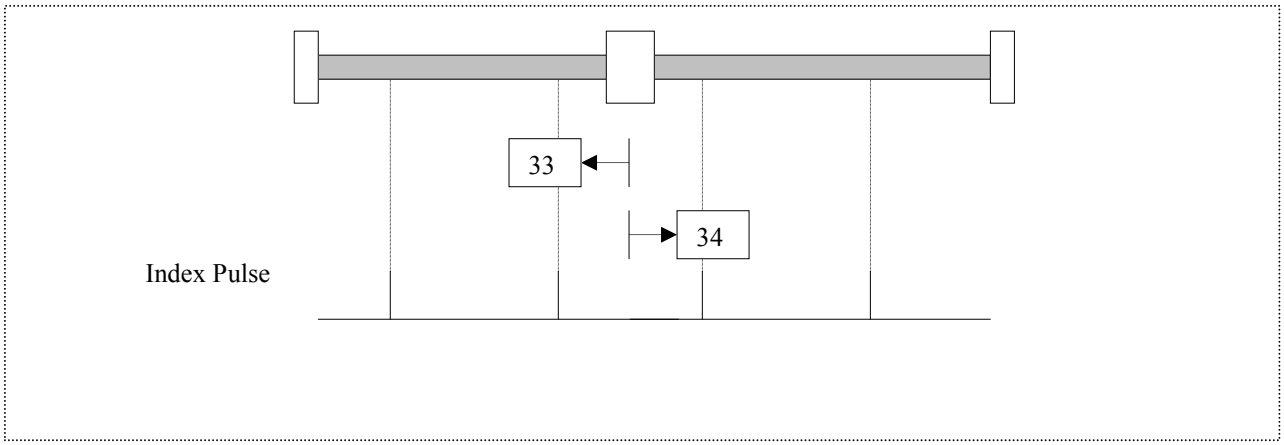


Type with resolver zero	Corresponding type without resolver zero
1	17
2	18
3	19
4	20
5	21
6	22
7	23
8	24
9	25
10	26
11	27
12	28
13	29
14	30

These Homing types are similar to types 1 to 14; the reference position does not depend on the Index Pulse (resolver zero) but only on transition of the Home Switch or relevant Limit Switch.

Type 31 and 32 : Reserved

Types 33 and 34 (F35=33-34 Index 6098=33-34): Homing on Index Pulse (resolver zero).



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.

Type 35 (F35=35 Index6098=35): Homing in the current position.

9 – ERROR MESSAGES

In the event of a malfunction, the drive sees to stopping the motor, visually displaying the type of error found. The triggering of a protection causes the OUT_FAULT output to switch. The protection resets opening the T_Enable contact if the command is via digital inputs, activating bit 7 of the Control_Word if the command is via Canopen or with an OF telegram if the command is via an RS232/485 connection.

INDICATION ON THE DISPLAY	VALUE OF F42	TYPE OF PROTECTION	DESCRIPTION OF THE MALFUNCTION
Ξ.VoLt	h 3100	Supply voltage out of limits.	Triggers when the supply voltage is below 190Vac or higher than 260Vac
Ξ OL IN	h 2310	Exceeding the rated current	Triggers when motor input is higher than the value set in F22 for a time longer than that set in F24
Ξ ICC	h 2340	Short circuit protection	Triggers when output current is higher than 6 A
Ξ tEmp	h 4310	Temperature inside the drive over the permitted limits	Triggers when the temperature inside the Drivert exceeds 80°C
Ξ PTC	h 4210	Motor thermal cutout probe	Triggers when motor winding is too hot
Ξ RSLV	h 7303	Resolver connection error	Triggers due to a broken or erroneous resolver connection
Ξ EEpr	h 5530	EEprom	Triggers when the Eeprom fails to work
Ξ Eposi	h 8611	Positioning error	The position wanted has not been reached correctly.

10 - CANOPEN

10.1 - DESCRIPTION OF THE PROTOCOL

CANopen is a high level protocol based on the Can serial Bus. Drivert 1000's hardware utilises an MCP2551 transceiver (Microchip) while the CAN controller is integrated in the DSP. The communication profile implemented is defined in the CiA DS301 V4.02 publication as regards the general protocol characteristics, and in the CiA DSP 402 V2.0 publication as regards the specific application for the drives (Drive and Motion Control). Both publications can be found at http://www.can-cia.org.

A differential pair with common return is used for CANopen communication, conforming to ISO 11898. Maximum length of the connection depends on communication speed (Baud rate) according to the following table, while 112 is the maximum number of devices that can be connected to the node.

Baud rate	Maximum Bus Length
1 Mbit/s	25 m
500 Kbit/s	100 m
250 Kbit/s	250 m
125 Kbit/s	500 m
100 Kbit/s	1000 m
50 Kbit/s	1000 m

10.2 – SETTING CANopen COMMUNICATION PARAMETERS

To use the CANopen communication it is necessary to set correct node speed in function F21 and a univocal node ID value inside the node in function F22.

10.3 - COMMUNICATION MODEL

The Drivert 1000 drive supports the following objects defined in the specifications:
DS301

- NMT service
- SYNC object
- EMCY object
- NODE GUARD object
- HEARTBEAT object
- PDO object
- SDO object

DSP402

- Device control state machine (dc)
- Factor group
- Profile position mode object (pp)
- Profile velocity mode object (pv)
- Profile torque mode object (tq)
- Homing mode object (hm)

10.3.1 - CAN DATA FRAME

CAN communication is the packet type, as described in the following figure.

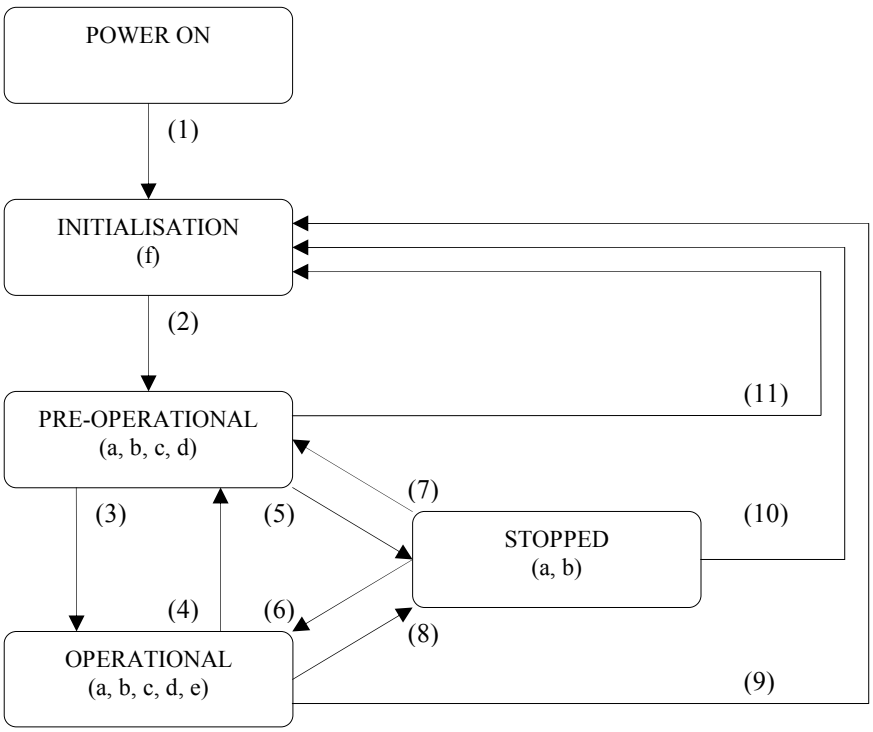
START OF FRAME	ARBITRATION FIELD			CONTROL FIELD	DATA FIELD	CRC	ACK	END OF FRAME
	COB-ID		RTR					
	FUNCTION CODE	NODE ID						
	BIT 10 9 8 7	BIT 6 5 4 3 2 1 0						
1 BIT	11 OR 29 BIT		1 BIT	6 BIT	0 TO 8 BYTE	16 BIT	2 BIT	7 BIT

10.3.2 – PREDEFINED COMMUNICATION OBJECTS

OBJECT	FUNCTION CODE (Binary)	COB-ID (Hex)	COB-ID (Dec)
NMT	0000	0x00	0
SYNC	0001	0x80	128
TIME STAMP	0010	0x100	256
EMERGENCY	0001	0x81 → 0xFF	129 → 255
PDO 1 TX	0011	0x181 → 0x1FF	385 → 511
PDO 1 RX	0100	0x201 → 0x27F	513 → 639
PDO 2 TX	0101	0x281 → 0x2FF	641 → 767
PDO 2 RX	0110	0x301 → 0x37F	769 → 895
PDO 3 TX	0111	0x381 → 0x3FF	897 → 1023
PDO 3 RX	1000	0x401 → 0x47F	1025 → 1151
PDO 4 TX	1001	0x481 → 0x4FF	1153 → 1279
PDO 4 RX	1010	0x501 → 0x57F	1281 → 1407
SDO TX	1011	0x581 → 0x5FF	1409 → 1535
SDO RX	1100	0x601 → 0x67F	1537 → 1663
NODEGUARD	1110	0x701 → 0x77F	1793 → 1919

10.3.3 - NETWORK MANAGEMENT PROTOCOL (NMT)

NMT protocol is used for network management and based on a Master/Slave relation. Drivert 1000 works as the NMT Slave in the states indicated in the following diagram:



(1)
When switched on it enters the INITIALISATION state automatically.

(2)
At the end of the INITIALISATION phase it enters PRE-OPERATIONAL automatically.

(3) (6)
Enters OPERATIONAL after reception of a Start Remote Node.

(4) (7)
Enters PRE-OPERATIONAL after reception of an ENTER THE PRE-OPERATIONAL STATE.

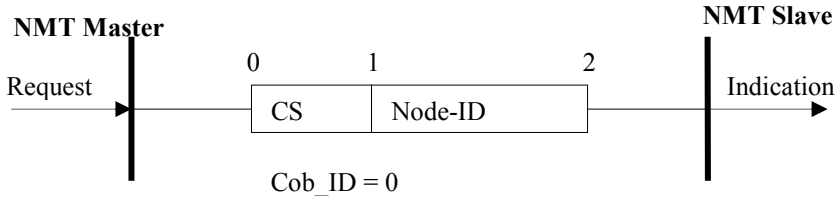
(5) (8)
Enters STOPPED after reception of a STOP REMOTE NODE.

(9) (10) (11)
Enters INITIALISATION after reception of a RESET NODE or RESET COMMUNICATION

Types of object permitted in the various states:

a) NMT
b) Node Guard
c) SDO
d) Emergency
e) PDO
f) Boot-up

NMT MESSAGE



NMT Protocol	Command Specifier CS (Dec.)	Note
Start_Remote_Node	001	Switches to the OPERATIONAL state
Stop_Remote_Node	002	Switches to the STOPPED state
Enter_Pre_Operational	128	Switches to the PRE-OPERATIONAL state
Reset_Node	129	Switches to the INITIALISATION state
Reset_Communication	130	Switches to the INITIALISATION state

DESCRIPTION OF THE OPERATIONAL STATES

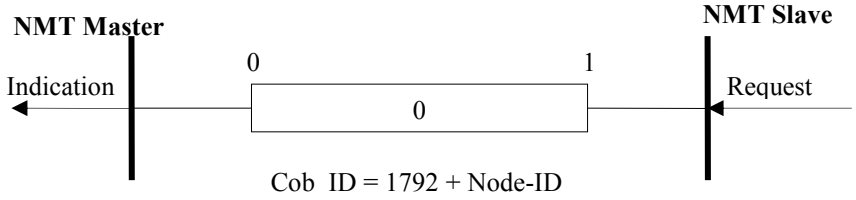
INITIALISATION: Subsequent to turning the drive on or after an NMT Reset_Node or Reset_Communication command has been given, the drive enters the *INITIALISATION* state. All communication parameters and functions are reset at the values saved previously. In this condition the drive is unable to receive SDO or PDO commands.

PRE-OPERATIONAL: At the end of the *INITIALISATION* phase the drive automatically enters the *PRE-OPERATIONAL* phase indicated by the Boot-Up message. In this condition the drive is able to accept SDO messages while the PDO messages are ignored. The drive cannot be enabled by the Control Word.

OPERATIONAL: Subsequent to a Start_Remote_Node command the drive enters the *OPERATIONAL* state. In this condition all PDO and SDO communication objects are active. The drive can be enabled by the Control Word.

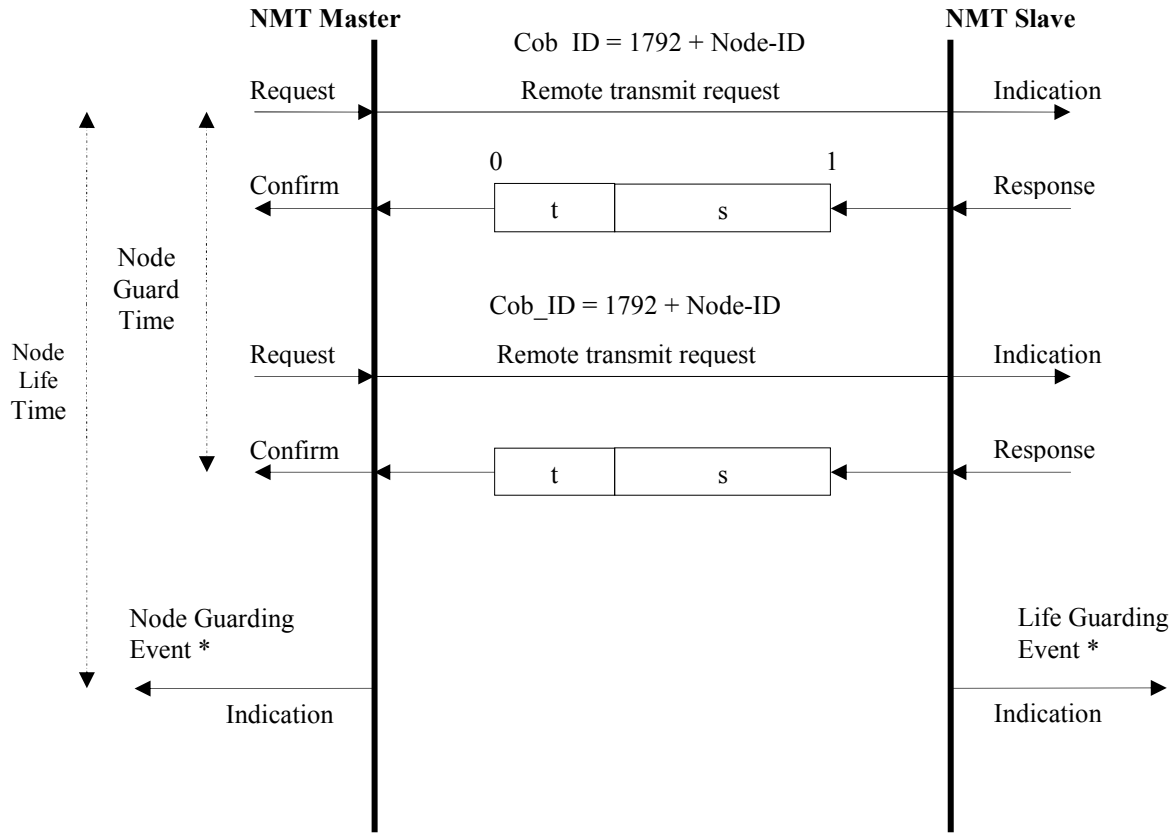
STOPPED: In this state it is controlled by an NMT Stop_Remote_Node message. In this condition the drive is disabled, communication is disabled except for the NMT protocol and Node Guarding.

BOOT-UP MESSAGE



This message is sent when the drive is turned on.

NMT NODE GUARDING PROTOCOL



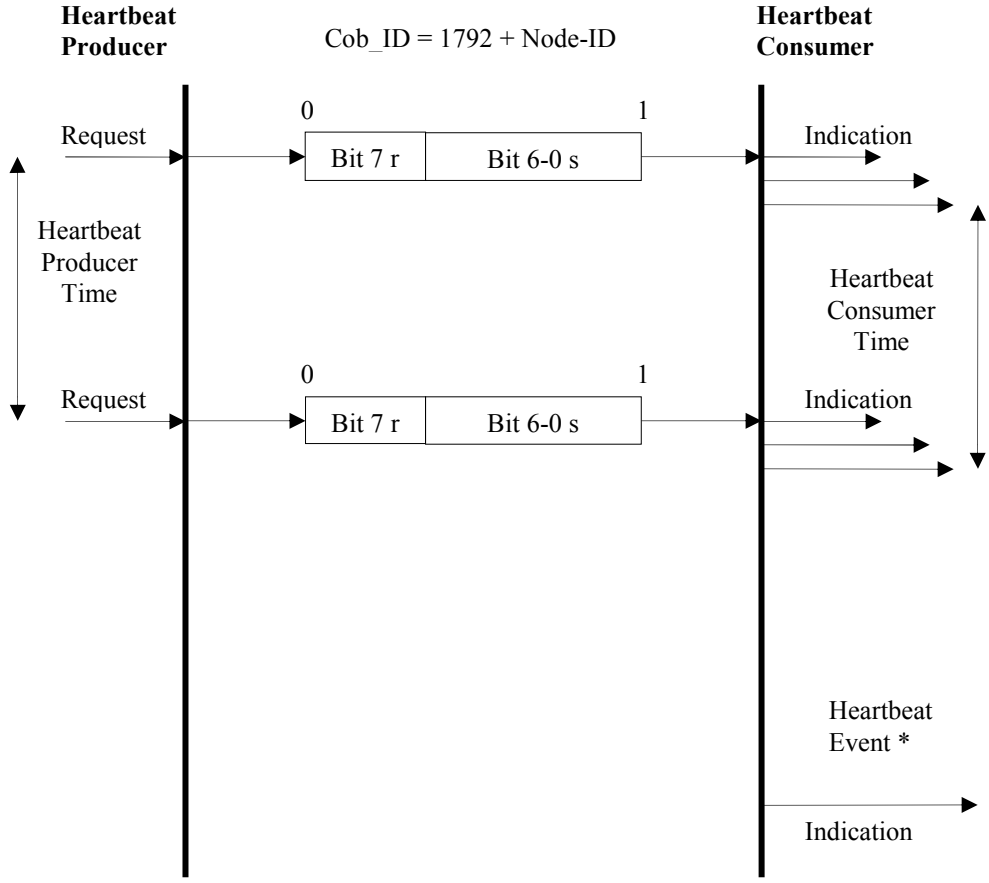
* In the event of a guarding error

s: status of the NMT slave device (Drivert1000)
- 4 – *STOPPED*
- 5 – *OPERATIONAL*
- 127 - *PRE-OPERATIONAL*

t: toggle bit. The value of the toggle bit alternates between two consecutive replies of the NMT Slave device

The NMT Master device interrogates all the NMT Slave devices at regular time intervals. The time interval is called Guard Time (Index 100Ch in ms) and must be different for each NMT Slave. The reply of each NMT Slave device contains the device's current operating status. The Node Life Time Factor (Index 100Dh) is a multiplicative factor of the Node Guard Time and determines Node Life Time (Life Time = Guard Time X Life Time Factor). If an NMT Slave device is not interrogated during its Life Time an error message is generated by means of the Life Guarding Event. The Node Guarding protocol is disabled when Guard Time is equal to zero or the Node Life Time Factor is equal to zero. It is not possible to use the Node Guarding protocol together with the HeartBeat protocol.

HEARTBEAT PROTOCOL



r: reserved always 0
s: status of the Heartbeat Producer device (Drivert1000)
0 - *BOOTUP*
4 – *STOPPED*
5 – *OPERATIONAL*
127 - *PRE-OPERATIONAL*

With the Heartbeat protocol the devices connected to the node can be monitored without the need for remote Frames. The Heartbeat Producer device transmits a Heartbeat message at regular intervals, and this time is set in object 1017h. The Heartbeat Consumer device receives the indication from the Producer device, verifying that the time between one message and another is included in the Heartbeat Consumer Time; if it isn't a Heartbeat event is generated. If this protocol is enabled it starts immediately during transition between the *INITIALISING* and *PRE-OPERATIONAL* state. The Heartbeat protocol is disabled when Producer Heartbeat Time is equal to zero. It is not possible to use the Heartbeat protocol together with the Node Guarding protocol.

10.3.4 - SERVICE DATA OBJECT (SDO)

The SDO protocol utilises confirmed messages for reading or writing access to the Object Dictionary when access times are not critical. If the data to transfer are less than 4 byte just the one frame is used, called SDO “expedit”, while if they are greater than 4 Byte they are segmented into several frames. The SDO protocol is always confirmed so each SDO transfer requires a minimum of two CAN frames, one for the server and one for the client.
The SDO protocol utilises two distinct Cob-Id, one used for messages sent from the CanOpen Master (SDO Client) to the drive (SDO Server), the other for messages sent from the SDO Server to the SDO Client:

- SDOTX = 580h + Node Id (Used for transferring from the SDO Server to the SDO Client)
- SDORX = 600h + Node Id (Used for transferring from the SDO Client to the SDO Server)

There are two different uses of the SDO protocol:
- SDO Download, used for writing data in the Object Dictionary of the SDO Server
- SDO Upload, used for reading data in the Object Dictionary of the SDO Server

10.3.5 - PROCESS DATA OBJECT (PDO)

The PDO protocol utilises a single non-confirmed message for transferring a maximum of 8 byte of data in real-time. The Drivert 1000 drive supports up to 4 PDOs in reception (PDO1RX, PDO2RX, PDO3RX, PDO4RX) and up to 4 PDOs in transmission (PDO1TX, PDO2TX, PDO3TX, PDO4TX). The PDOs in reception (PDORX) are used for transferring data from the Canopen Master to the drive while the PDOs in transmission (PDOTX) are used for transferring data from the drive (Slave) to the Canopen Master.
All PDOs have a univocal Cob_Id which is equal to:

- PDO1TX = 180h + Node Id
- PDO1RX = 200h + Node Id
- PDO2TX = 280h + Node Id
- PDO2RX = 300h + Node Id
- PDO3TX = 380h + Node Id
- PDO3RX = 400h + Node Id
- PDO4TX = 480h + Node Id
- PDO4RX = 500h + Node Id

Each PDORX or PDOTX can contain up to 4 objects (Mappable Object) of the object dictionary mapped inside it. Drivert 1000 has a Default mapping which can be changed and saved if wanted by means of the SDO protocol when the drive is in the PRE-OPERATIONAL state.

The PDO communication parameters can be accessed in the following indexes:

- PDO RX from index 1400h to index 1403h
- PDO TX from index 1800h to index 1803h

The PDO mapping parameters can be accessed in the following indexes:

- PDO RX from index 1600h to index 1603h
- PDO TX from index 1A00h to index 1A03h

PDO TRANSMISSION TYPE

The PDOs can be transmitted in two different ways:

- PDO Synchronous
- PDO Asynchronous

PDOTX Synchronous are messages sent only after reception of a specific number of SYNC Objects transmitted at regular intervals by the SYNC Producer. This allows synchronisation of the device in relation to the Canopen Master and any other Slaves on the node. The PDOTX Asynchronous are sent without any relation to the SYNC object. The transmission mode is determined by the "Transmission Type" value set in indexes 1800h – 1803h Sub-index 2.

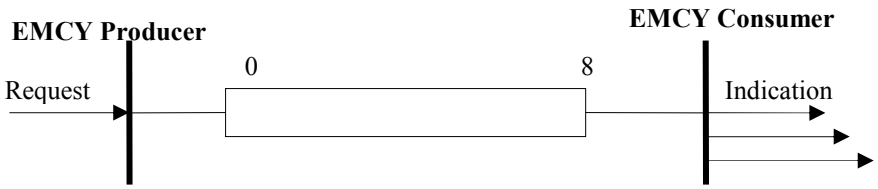
- Transmission Type equal to 0 determines a synchronous acyclic PDOTX transmitted after a SYNC object only if an internal trigger condition has occurred on the variation of the Status Word index 6041h object.
- With "Transmission Types" between 1 and 240, the PDOTX is sent in a synchronous acyclic manner after a number of SYNCs equal to the value set in "Transmission Type".
- With "Transmission Type" equal to 252, the PDOTX is sent in a synchronous acyclic manner following a remote RTR request after reception of a SYNC.
- With "Transmission Type" equal to 253, the PDOTX is sent in an asynchronous acyclic manner following an RTR remote request.
- With "Transmission Type" equal to 254 or 255, the PDOTX is sent in an asynchronous acyclic manner only if an internal trigger condition has occurred on the variation of the Status Word index 6041h object.

PDORX Synchronous are messages whose data are updated in the drive immediately after reception of a SYNC Object transmitted at regular intervals by the SYNC Producer. This allows synchronisation of the device in relation to the Canopen Master and any other Slaves on the node. PDORX Asynchronous are sent without any relation to the SYNC object. The data are updated in the drive immediately after reception. The transmission mode is determined by the "Transmission Type" value set in indexes 1400h – 1403h Sub-index 2.

- Transmission Types from 0 to 240 determine a synchronous PDORX whose data are updated in the drive immediately after a SYNC object.
- Transmission Types from 241 to 253 are reserved.
- Transmission Types 254 and 255 determine an asynchronous PDORX whose data are updated in the drive immediately after reception.

10.3.6 - EMERGENCY MESSAGE

The Emergency Object is sent if an internal protection triggers. This object is transmitted just the once for each protection trigger.

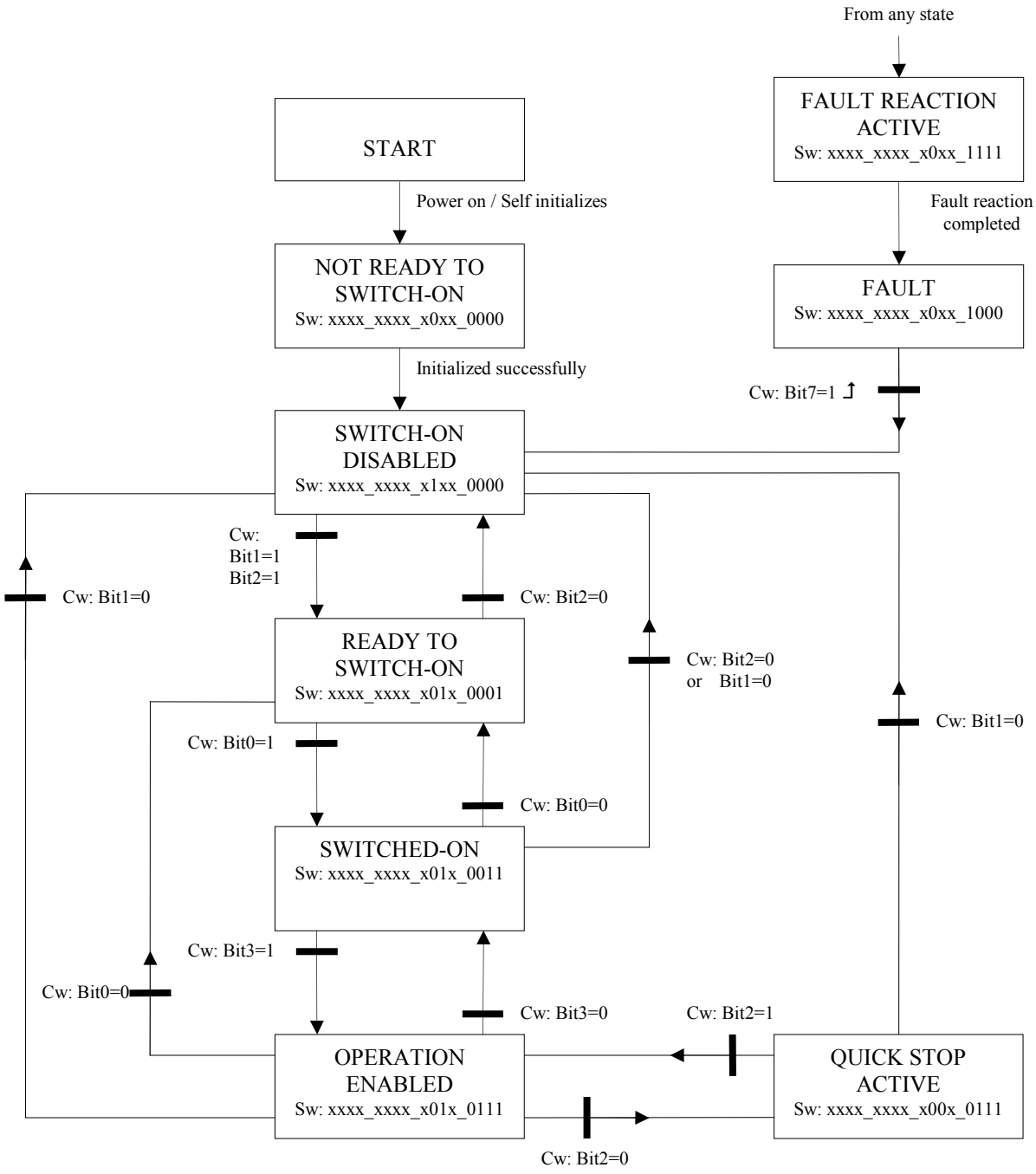


Cob_ID = 128 + Node ID

Error Type	Byte 0 and 1	Byte 2	Byte 2 – 8
	Emergency Error Code (Hex)	Error Register (Hex)	Not used
Overload	0x2310	Bit 1	/
Short circuit	0x2340	Bit 1	
Supply voltage out of limits	0x3100	Bit 2	
Interrupted motor phase	0x3321	Bit 5	
Revolver malfunction	0x7303	Bit 5	
Motor overtemperature	0x4210	Bit 3	
Drive overtemperature	0x4310	Bit 3	
Erroneous timing	0x6320	Bit 5	
Eeprom error	0x5530	Bit 5	
Functions limit error	0x6320	Bit 5	
Position error	0x8611	Bit 5	

10.4 – DRIVE CONTROLLED BY CANOPEN

In the case of remote control, the drive is controlled directly via SDO or PDO. Command of the drive states is controlled by the Controlword object (0x6040) and monitored by the Statusword object (0x6041). Passage from one state to another may only be done peer-to-peer with drive in *OPERATIONAL*.



Cw: Control word
Sw: Status word

10.4.1 – DESCRIPTION OF DRIVE STATES

State	Description
NOT READY TO SWITCH- ON	The drive has completed the initialisation phase and initial test and is disabled.
SWITCH-ON DISABLED	Drive parameters are set and can be changed, the drive is disabled.
READY TO SWITCH-ON	Drive parameters can be changed, the drive is disabled.
SWITCHED-ON	The power stage is ready, drive parameters can be changed, the drive is enabled only with speed control at zero speed or in torque control at zero torque. Target speed, position and torque are not processed.
OPERATION ENABLED	The power stage is ready, drive parameters can be changed. No protection has triggered (Fault). The drive is completely enabled.
QUICK STOP ACTIVE	The QUICK STOP function is executed. The drive is enabled, the parameters can be changed.
FAULT REACTION ACTIVE	A protection has triggered (Fault). The QUICK STOP function is executed. The drive is enabled, the parameters can be changed.
FAULT	A protection has triggered (Fault). The drive is disabled, the parameters can be changed.

10.4.2 – DESCRIPTION OF OBJECT 6040h

Control Word

The Control Word object is used to control drive states; single Bits can take on different meanings depending on the profile type controlled:

6040h Bit	Profile Position Mode (6060=1)	Profile Velocity Mode (6060=3)	Profile Torque Mode (6060=4)	Homing Mode (6060=6)
0	SWITCH-ON			
1	ENABLE VOLTAGE			
2	QUICK STOP			
3	ENABLE OPERATION			
4	NEW SET POINT	RESERVED	RESERVED	HOMING START
5	CHANGE SET IMMEDIATELY	RESERVED	RESERVED	RESERVED
6	ABSOLUTE / RELATIVE	RESERVED	RESERVED	RESERVED
7	FAULT RESET			
8	HALT			
9 - 10	RESERVED			
11 – 15	/			

10.4.3 – DESCRIPTION OF OBJECT 6041h

Status Word

The Status Word object is used to monitor drive state; single Bits can take on different meanings depending on the profile type controlled:

6041h Bit	Profile Position Mode	Profile Velocity Mode	Profile Torque Mode	Homing Mode
0	READY TO SWITCH-ON			
1	SWITCHED-ON			
2	OPERATION ENABLED			
3	FAULT			
4	VOLTAGE ENABLED			
5	QUICK STOP			
6	SWITCH-ON DISABLED			
7	WARNING			
8	\			
9	\			
10	TARGET REACHED			
11	INTERNAL LIMIT ACTIVE			
12	SET POINT ACKNOWLEDGE	SPEED	RESERVED	HOMING ATTAINED
13	FOLLOWING ERROR	\	RESERVED	HOMING ERROR
14 - 15	\			

10.5 – DESCRIPTION OF THE PROFILE VELOCITY MODE

This profile is used to obtain a feedback speed control. The motor command is given by the Control Word (6040h) and monitored by the Status Word object (6041h). By taking the drive to the "OPERATION ENABLED" state the motor starts with the acceleration defined in the "6083h" object to reach the reference speed set in object "60FF". The inputs to control Jog speed and the limit switches are always active.

The speed profile is defined by the following objects:

Object (hex)	Name	Value	Remarks
2007	Motion type selection	2	Enables commands from Canopen
6060	Modes of operation	3	Sets the Profile Velocity mode
60FF	Target Velocity	Custom	Reference speed in Rpm
6083	Profile Acceleration	Custom	Determines the time in ms to go from 0 to maximum speed defined in parameter 2003h
6084	Profile Deceleration	Custom	Determines the time in ms to go from maximum speed, defined in parameter 2003h, to 0
606D	Velocity window	Custom	Used to monitor speed
606E	Velocity window time	Custom	Used to monitor speed
606F	Velocity threshold	Custom	Used to monitor speed
6070	Velocity threshold time	Custom	Used to monitor speed
6070	Velocity threshold time	Custom	Used to monitor speed
606C	Velocity actual value	Custom	Returns instant speed in Rpm
6070	Velocity threshold time	Custom	Used to monitor speed
6085	Quick Stop Deceleration	Custom	Determines the time in ms to go from maximum speed, defined in parameter 2003h, to 0 when the command is given for a Quick Stop

10.6 – DESCRIPTION OF THE PROFILE POSITION MODE

This profile is used to obtain a position control. The motor command is given by the Control Word (6040h) and monitored by the Status Word object (6041h).

Single or multiple and absolute or relative positions can be controlled in the Profile Position Mode. A single position means that the positioning task has to be completed before a new task can be executed. In the case of multiple positionings, during execution of a task for the reception of a new command (position or speed update), the drive readjusts current motion in order to complete the new task.

In the case of relative positioning (incremental), the target position is added to the last target position executed; the direction of the motion therefore depends on the target sign.

In the case of absolute positioning, the target position refers to the home position.
The inputs to control Jog speed and the limit switches are always active.

The position profile is defined by the following objects:

Object (hex)	Name	Value	Remarks
2007	Motion type selection	2	Enables commands from Canopen
6060	Modes of operation	1	Sets the Profile Velocity mode
607A	Target Position	Custom	Reference position in position units
6081	Profile Velocity	Custom	Reference speed in Rpm
6093	Position Factor		Sets the conversion factor between the resolver units (4096 per rev.) and the required position unit.
6093 Sub. 1	Numerator Position Factor	Custom	
6093 Sub. 2	Divisor Position Factor	Custom	
6067	Position window	Custom	Used to monitor the position
6068	Position window time	Custom	Used to monitor the position
6065	Following error window	Custom	Used to monitor speed
6066	Following error time	Custom	Used to monitor speed
6064	Position actual value	Custom	Returns instant position
6070	Velocity threshold time	Custom	Used to monitor speed
6083	Profile Acceleration	Custom	Determines the time in ms to go from 0 to maximum speed defined in parameter 2003h
6084	Profile Deceleration	Custom	Determines the time in ms to go from maximum speed, defined in parameter 2003h, to 0
6085	Quick Stop Deceleration	Custom	Determines the time in ms to go from maximum speed, defined in parameter 2003h, to 0 when the command is given for a Quick Stop

10.7 – DESCRIPTION OF THE PROFILE TORQUE MODE

This profile is used to obtain torque control by adjusting the current supplied to the motor. The motor is controlled by the Control Word (6040h) and monitored by the Status Word object (6041h). By taking the drive to the "OPERATION ENABLED" state it supplies the current set in object 6071h to the motor. Object 6071h contains the torque reference expressed as a percentage of the peak-point current set in function F24. If the torque required by the motor is lower than the reference applied, speed is limited to the value set in function F03.

The speed profile is defined by the following objects:

Object (hex)	Name	Value	Remarks
2007	Motion type selection	2	Enables commands from Canopen
6060	Mode of operation	4	Sets the Profile Torque Mode
6071	Target Torque	Custom	Torque reference as a % of the peak-point current set in F24
F 24	Peak-point current	Custom	Maximum current value that can be supplied to the drive
6087	Torque slope	0	Limits torque variation as a % of nominal torque per second. Value cannot be changed.
6088	Torque profile type	0	Defines the type of ramp in torque control. Value 0 identifies a profile with a linear ramp (trapezoidal profile). Value cannot be changed.

10.8 - DESCRIPTION OF THE HOMING MODE

This profile is used to reset or refer the axis in the case of position control. The motor is controlled by the Control Word (6040h) and monitored by the Status Word object (6041h). To start the motor, take the drive to the "OPERATION ENABLED" condition and then activate bit 4 (HOMING_START) of the Control_Word.

The HOMING profile is defined by the following objects:

Object (hex)	Name	Value	Remarks
2007	Motion type selection	2	Enables commands from Canopen
6060	Modes of operation	6	Sets the homing mode
6099 Sub 1	Speed during search for switch	100	Sets the speed used to search for the Home Switch or Limit Switch according to the Homing type used
6099 Sub 2	Speed during search for zero	10	Sets the speed used to search for the index pulse
609A	Homing acceleration	100	Sets the acceleration/deceleration ramp used during homing
607C	Home Offset	0	Assigns a value to the Home position
6098	Homing type	1	Sets the Homing type used (see par. 8.6)

NOTE: The single Homing types are described in paragraph 8.6

10.9 – DICTIONARY OF THE OBJECTS

10.9.1 - COMMUNICATION PROFILE AREA (Object Index 1000h – 1FFFh)

INDEX (HEX)	SUB INDEX	NAME	TYPE	ATTRI-BUTE	DEFAULT	DESCRIPTION
1000	0	Device Type	Unsigned 32	RO	0x020192	Describes the type of device. It consists of two 16-bit fields, the first indicating the profile 0X0192 (DSP-402) and the second the device category 0x02 (Servo Drive)
1001	0	Error Register	Unsigned 8	RO		Error register coded in bit according to DS-301 Bit 0 – Generic error Bit 1 – Current Bit 2 – Voltage Bit 3 – Temperature Bit 4 – Communication error Bit 5 – Specific DSP-402 Bit 6 – Reserved Bit 7 – Characteristic of the manufacturer
1005 (F58)	0	Cob Id Sync	Unsigned 32	RW	0x080	Sync object ID
1006	0 (F142)	Communication Cycle Period	Unsigned 32	RO	0x0	Defines the interval between two Sync messages in uS
1008	0	Manufacturer Device Name	Visible string	RO	Minimotor S.R.L.Bagnolo	Contains the manufacturer's name
1009	0	Manufacturer Hardware Version	Visible string	RO	Drivert 1000 HW xx	Contains the drive's hardware version
100A	0	Manufacturer Software Version	Visible string	RO	Software version xx-xx-xxxx	Contains the drive's software version (date)
100B	0 (F143)	Node ID	Unsigned 32	RW	0x020	Defines the drive node value. The node can be changed also by way of function F22
100C	0 (F144)	Guard Time	Unsigned 16	RW	0x00	Used in the Node Guarding protocol to set the Life Time given by the Guard Time product (ms) X Life time Factor. With value 0 the protocol is disabled.
100D	0 (F145)	Life time factor	Unsigned 8	RW	0x00	
1010	0	Store Parameter	Unsigned 8	RO	0x01	Number of object sub-indexes
	1	Save All Parameter	Unsigned 32	RW	0x01	In reading 0x01 means it is possible to save the parameters In writing code 0x65766173 saves all parameters in EEprom
1012 (F59)	0	Cob Id Time Stamp Object	Unsigned 32	RO	0x100	Time Stamp object ID
1014 (F57)	0	Cob Id Emergency Message	Unsigned 32	RW	0x080 + Node ID	Emergency object ID
1017	0 (F178)	Producer Heartbeat Time	Unsigned 16	RW	0x00	Used in the Heartbeat protocol to define the cycle in ms. With value 0 the protocol is disabled.
1018	0	Identity Object	Unsigned 8	RO	0x01	Number of object sub-indexes
	1	Vendor ID	Unsigned 32	RO		Manufacturer Cia ID code.
1200	0	Server SDO Parameter	Unsigned 8	RO	0x02	Number of object sub-indexes
	1 (F60)	Server SDO Cob Id Rx	Unsigned 32	RW	0x600+Node ID	ID in reception Client to Server in the SDO protocol
	2 (F61)	Server SDO Cob Id Tx	Unsigned 32	RW	0x580+Node ID	ID in transmission Server to Client in the SDO protocol
1400	0	PDO 1 Rx Parameter	Unsigned 8	RO	0x02	Number of object sub-indexes
	1 (F70)	PDO 1 Rx Cob Id	Unsigned 32	RW	0x200+Node ID	PDO 1 Rx ID
	2 (F62)	Transmission Type	Unsigned 8	RW	0x0FF	Transmission type
1401	0	PDO 2 Rx Parameter	Unsigned 8	RO	0x02	Number of object sub-indexes
	1 (F71)	PDO 2 Rx Cob Id	Unsigned 32	RW	0x300+Node ID	PDO 2 Rx ID
	2 (F63)	Transmission Type	Unsigned 8	RW	0x0FF	Transmission type
1402	0	PDO 3 Rx Parameter	Unsigned 8	RO	0x02	Number of object sub-indexes
	1 (F72)	PDO 3 Rx Cob Id	Unsigned 32	RW	0x400+Node ID	PDO 3 Rx ID
	2 (F64)	Transmission Type	Unsigned 8	RW	0x0FF	Transmission type
1403	0	PDO 4 Rx Parameter	Unsigned 8	RO	0x02	Number of object sub-indexes
	1 (F73)	PDO 4 Rx Cob Id	Unsigned 32	RW	0x500+Node ID	PDO 4 Rx ID
	2 (F65)	Transmission Type	Unsigned 8	RW	0x0FF	Transmission type

INDEX (HEX)	SUB INDEX	NAME	TYPE	ATTRI-BUTE	DEFAULT	DESCRIPTION
1600	0	PDO 1 Rx Mapping	Unsigned 8	RO	0x04	Number of object sub-indexes
	1 (F79-78)	1st Object mapped	Unsigned 16	RW	0x60400010	
	2 (F81-80)	2nd Object mapped	Unsigned 8	RW	0x20500008	
	3 (F83-82)	3rd Object mapped	Unsigned 8	RW	0x60600008	
	4 (F85-84)	4th Object mapped	Unsigned 32	RW	0x60ff0020	
1601	0	PDO 2 Rx Mapping	Unsigned 8	RO	0x04	Number of object sub-indexes
	1 (F87-86)	1st Object mapped	Unsigned 16	RW	0x60400010	
	2 (F89-88)	2nd Object mapped	Unsigned 8	RW	0x20500008	
	3 (F91-90)	3rd Object mapped	Unsigned 8	RW	0x60600008	
	4 (F93-92)	4th Object mapped	Unsigned 32	RW	0x607A0020	
1602	0	PDO 3 Rx Mapping	Unsigned 8	RO	0x04	Number of object sub-indexes
	1 (F95-94)	1st Object mapped	Unsigned 16	RW	0x60400010	
	2 (F97-96)	2nd Object mapped	Unsigned 8	RW	0x20500008	
	3 (F99-98)	3rd Object mapped	Unsigned 8	RW	0x60600008	
	4 (F101-100)	4th Object mapped	Unsigned 32	RW	0x60810020	
1603	0	PDO 4 Rx Mapping	Unsigned 8	RO	0x04	Number of object sub-indexes
	1 (F103-102)	1st Object mapped	Unsigned 32	RW	0x60830020	
	2 (F105-104)	2nd Object mapped	Unsigned 32	RW	0x60840020	
	3 (F107-106)	3rd Object mapped	Unsigned 32	RW	0	
	4 (F109-108)	4th Object mapped	Unsigned 32	RW	0	
1800	0	PDO 1 Tx Parameter	Unsigned 8	RO	0x02	Number of object sub-indexes
	1 (F74)	PDO 1 Tx Cob Id	Unsigned 32	RW	0x180+Node ID	PDO 1 Tx ID
	2 (F66)	Transmission Type	Unsigned 8	RW	253	Transmission type
1801	0	PDO 2 Tx Parameter	Unsigned 8	RO	0x02	Number of object sub-indexes
	1 (F75)	PDO 2 Tx Cob Id	Unsigned 32	RW	0x280+Node ID	PDO 2 Tx ID
	2 (F67)	Transmission Type	Unsigned 8	RW	253	Transmission type
1802	0	PDO 3 Tx Parameter	Unsigned 8	RO	0x02	Number of object sub-indexes
	1 (F76)	PDO 3 Tx Cob Id	Unsigned 32	RW	0x380+Node ID	PDO 3 Tx ID
	2 (F68)	Transmission Type	Unsigned 8	RW	253	Transmission type
1803	0	PDO 4 Tx Parameter	Unsigned 8	RO	0x02	Number of object sub-indexes
	1 (F77)	PDO 4 Tx Cob Id	Unsigned 32	RW	0x480+Node ID	PDO 4 Tx ID
	2 (F69)	Transmission Type	Unsigned 8	RW	253	Transmission type
1A00	0	PDO 1 Tx Mapping	Unsigned 8	RO	0x04	Number of object sub-indexes
	1 (F111-110)	1st Object mapped	Unsigned 16	RW	0x60410010	
	2 (F113-112)	2nd Object mapped	Unsigned 8	RW	0x60610008	
	3 (F115-114)	3rd Object mapped	Unsigned 32	RW	0x606c0020	
	4 (F117-116)	4th Object mapped	-	RW	0	
1A01	0	PDO 2 Tx Mapping	Unsigned 8	RO	0x04	Number of object sub-indexes
	1 (F119-118)	1st Object mapped	Unsigned 16	RW	0x60410010	
	2 (F121-120)	2nd Object mapped	Unsigned 8	RW	0x60610008	
	3 (F123-122)	3rd Object mapped	Unsigned 32	RW	0x60640020	
	4 (F125-124)	4th Object mapped	-	RW	0	
1A02	0	PDO 3 Tx Mapping	Unsigned 8	RO	0x04	Number of object sub-indexes
	1 (F127-126)	1st Object mapped	Unsigned 16	RW	0x60410010	
	2 (F129-128)	2nd Object mapped	Unsigned 8	RW	0x60610008	
	3 (F131-130)	3rd Object mapped	Unsigned 32	RW	0x60640020	
	4 (F133-132)	4th Object mapped	-	RW	0	
1A03	0	PDO 4 Tx Mapping	Unsigned 8	RO	0x04	Number of object sub-indexes
	1 (F135-134)	1st Object mapped	Unsigned 16	RW	0x60410010	
	2 (F137-136)	2nd Object mapped	Unsigned 8	RW	0x60610008	
	3 (F139-138)	3rd Object mapped	Unsigned 32	RW	0x60640020	
	4 (F141-140)	4th Object mapped	-	RW	0	

10.9.2 – SPECIFIC MANUFACTURER PROFILE AREA (Object Index 2000h – 5FFFh) (Integer32)

Functions from F00 to F42 (see Chap. 6)

INDEX (hex)	SUB INDEX	NAME	UNIT	ATTRI-BUTE	RANGE (dec)	DESCRIPTION
2000	0	F00	Rpm	RW	-6000 ÷ 6000	Reference speed
2001	0	F01	mV	RW	-9999 ÷ 10000	Speed reference analogue offset
2002	0	F02	Rpm	RW	1 ÷ 6000	Jog speed
2003	0	F03	Rpm	RW	1 ÷ 6000	Speed Max
2004	0	F04	Ms	RW	5 ÷ 10000	Acceleration ramp
2005	0	F05	Ms	RW	5 ÷ 10000	Deceleration ramp
2006	0	F06	ms	RW	5 ÷ 10000	Jog acc/dec ramp and Limit switch
2007	0	F07		RW	0 – 1 - 2	Commands origin
2008	0	F08		RW	0 – 1	Rotation sense reversal
2009	0	F09		RW	0 – 1 – 2 - 3	Speed reference type
200a	0	F10		RW	0 – 1 – 2 – 3 – 4	Control type
200b	0	F11		RW	0–1–2–3–4–5	Display
200c	0	F12		RW	-200.0000000 ÷ +200.0000000	Master encoder tracking ratio
200d	0	F13		RW	0 ÷ 2147483647	Position factor numerator
200e	0	F14		RW	0 ÷ 2147483647	Position factor denominator
200f	0	F15		RW	0 ÷ 1024	Simulated encoder pulses
2010	0	F16	Rpm	RW	0 ÷ 6000	Speed analogue output scale
2011	0	F17	mA	RW	100 ÷ 12000	Torque analogue output scale
2012	0	F18		RW	1~~0~~ ÷ 127	Device number
2013	0	F19		RW	0 – 1 – 2 – 3 – 4	Serial com. speed (4800/9600/19200/38400/57600) Baud
2014	0	F20		RW	0 – 1	Serial type 0 - Rs232 1- RS485
2015	0	F21		RW	0–1–2–3–4–5-6-7-8-9	Canopen field bus communication speed (10/20/50/100/125/250/400/500/800/1000) Kbit/s
2016	0	F22		RW	1 ÷ 127	Canopen ID node
2017	0	F23	mA	RW	100 ÷ 6000	Motor rated current
2018	0	F24	mA	RW	100 ÷ 12000	Motor peak-point current
2019	0	F25	Sec.	RW	0 ÷ 5	Peak-point current time constant
201a	0	F26		RW	10 ÷ 1000	Proportional speed error factor
201b	0	F27		RW	10 ÷ 1000	Integral speed error factor
201c	0	F28		RW	10 ÷ 30000	Proportional position error factor
201d	0	F29		RW	0 ÷ 1000	Derivative position error factor
201e	0	F30		RW	0 ÷ 4000	Integral position error factor
201f	0	F31	ms	RW	1 ÷ 3000	Mechanical time constant
2020	0	F32		RW	0 ÷ 500	Acceleration compensation
2021	0	F33		RW	10 ÷ 20000	Integral current control factor
2022	0	F34		RW	1 ÷ 500	Proportional current control factor
2023	0	F35		RW	1 ÷ 35	Homing type
2024	0	F36	Rpm	RW	1 ÷ 6000	Switch search speed
2025	0	F37	Rpm	RW	1 ÷ 6000	Resolver zero search speed
2026	0	F38	ms	RW	10 ÷ 10000	Homing acceleration/deceleration
2027	0	F39		RW	Variable depending on the position factor	Home Offset
2028	0	F40			0 – 1 – 2	Profiles page
2029	0	F41		RW	0 / 8	Motor type
202A	0	F42		RO		Error code
2050	0	F160	Unsigned 8	RW		Control_word_1

128 motion profiles table (see Chap. 7)

2100	0	Motion type			128	Number of sub-indexes
	1	Tip (00)		RW	0–1–2–3–4–5-6-7-8	Motion profile type 00h
	2	Tip (01)		RW	0–1–2–3–4–5-6-7-8	Motion profile type 01h
	xx	Tip (xx)		RW	0–1–2–3–4–5-6-7-8	Motion profile type xxh
	128	Tip (7F)		RW	0–1–2–3–4–5-6-7-8	Motion profile type 7Fh (127)

2101	0	Acceleration ramp			128	Number of sub-indexes
	1	Acc (00)	ms	RW	-10000 ÷ 10000	Profile acceleration ramp 00h
	2	Acc (01)	ms	RW	-10000 ÷ 10000	Profile acceleration ramp 01h
	xx	Acc (xx)	ms	RW	-10000 ÷ 10000	Profile acceleration ramp xxh
	128	Acc (7F)	ms	RW	-10000 ÷ 10000	Profile acceleration ramp 7Fh (127)

2102	0	Speed			128	Number of sub-indexes
	1	Vel (00)	Rpm	RW	-6000 ÷ 6000	Profile speed 00h
	2	Vel (01)	Rpm	RW	-6000 ÷ 6000	Profile speed 01h
	xx	Vel (xx)	Rpm	RW	-6000 ÷ 6000	Profile speed xxh
	128	Vel (7F)	Rpm	RW	-6000 ÷ 6000	Profile speed 7Fh (127)

2103	0	Deceleration ramp			128	Number of sub-indexes
	1	Dec (00)	ms	RW	5 ÷ 10000	Profile deceleration ramp 00h
	2	Dec (01)	ms	RW	5 ÷ 10000	Profile deceleration ramp 01h
	xx	Dec (xx)	ms	RW	5 ÷ 10000	Profile deceleration ramp xxh
	128	Dec (7F)	ms	RW	5 ÷ 10000	Profile deceleration ramp 7Fh (127)

2104	0	Profiles target whole part			128	Number of sub-indexes
	1	TRI (00)	Integer 32	RW	Variable depending on the position factor	Profile target 00h (whole part)
	2	TRI (01)	Integer 32	RW		Profile target 01h (whole part)
	xx	TRI (xx)	Integer 32	RW		Profile target xxh (whole part)
	128	TRI (7F)	Integer 32	RW		Profile target 7Fh (127) (whole part)

2105	0	Profiles target decimal part			128	Number of sub-indexes
	1	TRD (00)	Unsigned 32	RW	Variable depending on the position factor	Profile target 00h (decimal part)
	2	TRD (01)	Unsigned 32	RW		Profile target 01h (decimal part)
	xx	TRD (xx)	Unsigned 32	RW		Profile target xxh (decimal part)
	128	TRD (7F)	Unsigned 32	RW		Profile target 7Fh (127) (decimal part)

2106	0	Master encoder tracking ratio			128	Number of sub-indexes
	1	Res (00)	Integer 32	RW	-200.0000000 ÷ +200.0000000	Profile ratio 00h. The value is divided by 10000000
	2	Res (01)	Integer 32	RW		Profile ratio 01h. The value is divided by 10000000
	xx	Res (xx)	Integer 32	RW		Profile ratio xxh. The value is divided by 10000000
	128	Res (7F)	Integer 32	RW		Profile ratio 7Fh. The value is divided by 10000000

10.9.3 - STANDARDIZED DEVICE PROFILE AREA (Object Index 6000h – 9FFFh)

INDEX (HEX)	SUB INDEX	NAME	TYPE	ATTRI-BUTE	DEFAULT	DESCRIPTION
603F	0	Error Code	Unsigned 16	RO		
6040 M	0 (F146)	Control Word	Unsigned 16	RW	0	Controls machine state
6041 M	0 (F162)	Status Word	Unsigned 16	RO	0	Displays machine state
6060 M	0 (F147)	Mode of Operation	Integer 8	RW	3	Changes operating mode: -1 Table 128 motion profiles 1 Position profile 3 Speed profile 4 Torque profile 6 Homing
6061 M	0 (F148)	Mode of Operation Display	Integer 8	RO		Displays ongoing operating mode.
6064 M	0 (F176-177)	Position Actual Value	Integer 32	RO		Indicates the instant position in position units.
6065	0 (F149)	Following error window	Unsigned 32	RW	1000	
6066	0 (F151)	Following error time out	Unsigned 16	RW	50	
6067	0 (F152)	Position window	Unsigned 32	RW	10	
6068	0 (F154)	Position window time	Unsigned 16	RW	50	
6069 M	0	Velocity sensor actual value	Integer 32	RO		Speed read by the sensor in resolver units per second
606B	0	Velocity demand value	Integer 32	RO		
606C M	0	Velocity actual value	Integer 32	RO		Speed read by the sensor in rpm
606D	0 (F155)	Velocity window	Unsigned 16	RW	50	Defines the velocity window in rpm
606E	0 (F156)	Velocity window time	Unsigned 16	RW	50	SW bit 10 (target reached) is set when the difference between Target velocity and Actual Velocity is within the Velocity window for a time longer than the Velocity window time. It is expressed in ms.
606F	0 (F157)	Velocity threshold	Unsigned 16	RW	50	Defines the velocity threshold in rpm
6070	0 (F158)	Velocity threshold time	Unsigned 16	RW	50	When the Actual Velocity is higher than the Velocity threshold for a time longer than the Velocity threshold time, SW's bit 12 (Velocity=0) is reset. It is expressed in ms.
6071 M	0 (F159)	Target torque	Integer 16	RW	100	Target torque by a thousand of the rated current
6075	0	Motor rated current	Unsigned 32	RW		Motor rated current in mA
607A M	0 (F163)	Target position	Integer 32	RW	0	Target position in position units
607C M	0 (F165)	Home offset	Integer 32	RW	0	Sets the difference between the zero position of the application and zero found during homing
6081 M	0 (F167)	Profile velocity	Unsigned 32	RW	1000	Speed in rpm used in the profile position to execute a positioning

INDEX (HEX)	SUB INDEX	NAME	TYPE	ATTRI-BUTE	DEFAULT	DESCRIPTION
6083 M	0 (F168)	Profile acceleration	Unsigned 32	RW	100	Defines the acceleration time in ms used in the profile position to execute a positioning
6084 M	0 (F169)	Profile deceleration	Unsigned 32	RW	100	Defines the deceleration time in ms used in the profile position to execute a positioning
6085 M	0 (F170)	Quick stop deceleration	Unsigned 32	RW	10	Defines the deceleration time in ms used when the command is given for a Quick stop
6086	0 (F171)	Motion profile type	Integer 16	RO	0	Defines the type of motion in position control. Value 0 identifies a profile with a linear ramp (Trapezoidal profile).
6087	0	Torque slope	Unsigned 32	RO	0	Limits torque variation as a % of the nominal torque per second.
6088	0 (F173)	Torque profile type	Integer 16	RO	0	Defines the ramp type in torque control. Value 0 identifies a profile with a linear ramp (Trapezoidal profile).
6089	0 (F174)	Position notation index	Unsigned 8	RO	0	
608A	0 (F175)	Position dimension index	Unsigned 8	RO	0	
608B	0	Velocity notation index	Unsigned 8	RO	0	
608C	0	Velocity dimension index	Unsigned 8	RO	0	
608D	0	Acceleration notation index	Unsigned 8	RO	0	
608E	0	Acceleration dimension index	Unsigned 8	RO	0	
6093	0	Position factor			2	Number of sub-indexes
	1 (F13)	Numerator	Unsigned 32	RW	1	Converts the position units in the internal unit (resolver unit).
	2 (F14)	Feed constant	Unsigned 32	RW	1	
6098 M	0 (F183)	Homing Method	Integer 8	RW	1	Establishes the Homing type
6099	0	Homing speeds			2	Number of sub-indexes
	1 (F184)	Speed during search for switch	Unsigned 32	RW	100	Sets the speed used during the homing procedure to search for the switch.
	2 (F185)	Speed during search for zero	Unsigned 32	RW	10	Sets the speed used during the homing procedure to search for the resolver zero.
609A	0 (F186)	Homing Acceleration	Unsigned 32	RW	100	Sets the acceleration/deceleration ramp in ms in the homing procedure.
60FF M	0 (F187)	Target velocity	Integer 32	RW	1000	Sets the speed reference in Rpm for the Speed profile

11 - SERIAL COMMUNICATION

Drivert 1000 can be connected to a PC or PLC by one of the 2 available serial connections, RS232 or RS485. By using serial communication it is possible to modify the functions of programmable profiles, monitor operating parameters and give motion commands to the drive. Serial communication is always available while motion commands are active only with F07=3. The drive replies only when a valid telegram is received and executable with a delay ranging between 5 ms and 30 ms. The characters comprising a telegram must be sent consecutively without delays. If the telegram is incomplete, 2 ms after the last character has been received the reception buffer is deleted. With the device number equal to 0 all the drives connected to the network (RS485) execute the command but do not answer.

11.1 – TRANSMISSION PROTOCOL

Communication is the 8-bit asynchronous type without parity with a stop bit (8N1). Communication speed can be selected with the function F19 (4800 / 9600 / 19200 / 38400 / 57600 Baud). The device number set in F18 (1/127) makes it possible to communicate with a particular device connected to an RS485 network. One of the two serial connections is enabled with function F20: 0 for RS485 and 1 for RS232.

11.1.1 – COMMAND STRINGS FORMAT

The transmission telegram is comprised as follows:

Device number	Command	Value	Value 1	Value n	Checksum

- Device number : binary number from 0 (00000000 b) to 32 (00010000 b)
- Command : 1 or 2 ASCII characters
  - E Echo enable
  - P Profile writing
  - OP Profile command
  - RP Profile reading
  - F Function writing
  - RF Function reading
  - SF Saving functions
  - RM Reading measurements
  - RT Reading instant position
  - A Homing command
  - TA Absolute positioning command
  - TR Relative positioning command
  - ON Motion command
  - OF Stop command
- Value: expressed with a binary number 1, 2 or 4 byte
- Checksum: XOR of all characters preceding the checksum

The command strings can contain a variable number of characters based on the type of command sent.

11.1.2 ECHO ENABLE COMMAND (E) (4 byte)

Used to enable the echo on replies: 0 disabled / 1 enabled**.**

ND (F18)	Command	Value	Checksum
0 / 127	E	0 / 1	0 / 255
1 byte	1 byte	1 byte	1 byte

REPLY TO COMMANDS
Command received correctly (3 byte) Reply = Device number + O + K

11.1.3 MOTION PROFILE WRITING COMMAND (P) (24 byte)

Used to store a motion profile in the EEprom.

ND (F18)	Command	Profile No.	Type	Acc. (ms)	Speed	Dec. (ms)	Target		Encoder tracking ratio	Profile page	Check sum
							Whole	Decimal			
0 / 127	P	0 / 127	0 / 7	5 / 10000	-6000 / 6000	5 / 10000	Variable depending on the position factor		-200.0000000 / 200.0000000	0 / 127	0 / 255
1 byte	1 byte	1 byte	1 byte	2 byte	2 byte	2 byte	4 byte	4 byte	4 byte	1 byte	1 byte

Example

Description	Decimal value to save	Decimal value to transmit	Binary value to transmit	ASCII code of the character to transmit.
Device number	32	32	00100000	32
Command	P (ASCII 80)	80	01010000	80
Profile No.	127	127	01111111	127
Type	1	1	00000001	1
Acceleration	1000	1000	00000011 – 11101000	3 - 232
Speed	5000	5000	00010011 – 10001000	19 - 136
Deceleration	230	230	00000000 – 11100110	0 - 230
Target Whole part	-4325	$-4325 + 2^{32}$	11111111 – 11111111 – 11101111 - 00011011	255 – 255 – 239 - 27
Target Decimal part	12345678	$0{,}12345678 * 2^{32} = 530242832$	00011111 – 10011010 – 11011101 - 00010000	31 – 154 – 221 - 16
Encoder tracking ratio	12.1234567	12.1234567 * 10000000 = 121234567	00000111 – 00100111 – 00001110 – 00000000 NOTE: The number to save must be multiplied by 10000000.	7 – 39 – 14 - 0
Profiles page	0	0	00000000	0
Checksum			01111001	121

REPLY TO COMMANDS WITHOUT ECHO
Command received correctly (3byte)
Reply = Device number + O + K
Commands received correctly, but with values outside the limit, are not executed.

REPLY TO COMMANDS WITH ECHO (25 byte)
The reply is identical to the telegram transmitted + the characters “O” and “K” in place of the checksum.

11.1.4 PROFILE COMMAND (OP) (5 byte)

Use the “OP” command with the number of the profile to execute. The profile is executed immediately after receiving the telegram.

ND (F18)	Command	Value	Checksum
0 / 127	OP	0 / 127	0 / 255
1 byte	2 byte	1 byte	1 byte

REPLY TO COMMANDS WITHOUT ECHO
Command received correctly (3 byte) Reply = Device number + O + K

REPLY TO COMMANDS WITH ECHO (6 byte)
The reply is identical to the telegram transmitted + the characters “O” and “K” in place of the checksum.

11.1.5 – MOTION PROFILE READING COMMAND (RP) (5 byte)

Used to read a motion profile.

ND (F18)	Command	Profile No.	Checksum
1 / 127	RP	0 / 127	0 / 255
1 byte	2 byte	1 byte	1 byte

REPLY (25 byte)

ND (F18)	Command	Profile No.	Type	Acc. (ms)	Speed	Dec. (ms)	Target		Encoder tracking ratio	Profile page	Check sum
							Whole	Decimal			
1 / 127	RP	0 / 127	0 / 7	5 / 10000	-6000 / 6000	5 / 10000	Variable depending on the position factor		-200.0000000 / 200.0000000	0 / 127	0 / 255
1 byte	2 byte	1 byte	1 byte	2 byte	2 byte	2 byte	4 byte	4 byte	4 byte	1 byte	1 byte

NOTE: The encoder tracking ratio received is expressed by a whole value that has to be divided by 10000000 to obtain the decimal value.

11.1.6 – FUNCTION CHANGE COMMAND (F) (8 byte)

Used to modify the value of a function.
*NOTE: The change made is not saved automatically in the EEPROM. If you want to keep the value stored even after switching the drive off, command saving with the **SF** command .*

ND (F18)	Command	Function No.	Value	Checksum
0 / 127	F	0 / 43	Variable based on the written function	0 / 255
1 byte	1 byte	1 byte	4 byte	1 byte

REPLY TO COMMANDS WITHOUT ECHO
Command received correctly (3 byte)
Reply = Device number + O + K
Commands received correctly, but with values outside the limit, are not executed.

REPLY TO COMMANDS WITH ECHO (9 byte)
The reply is identical to the telegram transmitted + the characters “O” and “K” in place of the checksum.

11.1.7 – FUNCTION READING COMMAND (RF) (5 byte)

Used to read the value of a function.

ND (F18)	Command	Function No.	Checksum
1 / 127	RF	0 / 43	0 / 255
1 byte	2 byte	1 byte	1 byte

REPLY (9 byte)

ND (F18)	Command	Function No.	Value	Checksum
1 / 127	RF	0 / 43	Value contained in the function	0 / 255
1 byte	2 byte	1 byte	4 byte	1 byte

11.1.8 – FUNCTION SAVE COMMAND (SF) (4 byte)

Used to save the functions modified with command **F** in the EEPROM.

ND (F18)	Command	Checksum
0 / 127	SF	0 / 255
1 byte	2 byte	1 byte

REPLY TO COMMANDS WITHOUT ECHO
Command received correctly (3 byte)
Reply = Device number + O + K

REPLY TO COMMANDS WITH ECHO (5 byte)
The reply is identical to the telegram transmitted + the characters "O" and "K" in place of the checksum.

11.1.9 – MEASUREMENTS READING COMMAND (RM) (5 byte)

Used to read the instant drive operating parameters as visually displayed.

ND (F18)	Command	Measurement No.	Checksum
1 / 127	RM	0 / 5	0 / 255
1 byte	2 byte	1 byte	1 byte

Measurement No.:0) Rotation speed in Rpm
1) Current input in mA
2) Supply voltage in Vac
3) Internal Drivert temperature in °C
4) Position
5) Profile in execution

REPLY (9 byte)

ND (F18)	Command	Measurement No.	Value	Checksum
1 / 127	RM	0 / 5	Value of the measurement required	0 / 255
1 byte	2 byte	1 byte	4 byte	1 byte

11.1.10 – INSTANT POSITION READING COMMAND (RT) (4 byte)

ND (F18)	Command	Checksum
1 / 127	RT	0 / 255
1 byte	2 byte	1 byte

REPLY (13 byte)

<table>
<tr><td>ND (F18)</td><td>Command</td><td>State</td><td colspan="2">Target</td><td>Checksum</td></tr>
<tr><td>1 / 127</td><td>RT</td><td>0/255</td><td>Whole</td><td>Decimal</td><td>0 / 255</td></tr>
<tr><td rowspan="2">1 byte</td><td rowspan="2">2 byte</td><td>Bit 0 – Fault
Bit 1 – I^2t
Bit 2 – Limit Switch
Bit 3 – Enabled
Bit 4 – Position
Bit 5 – Speed
Bit 6 – Homing
Bit 7 - Sync</td><td colspan="2">Variable depending on the position factor</td><td rowspan="2">1 byte</td></tr>
<tr><td>1 byte</td><td>4 byte</td><td>4 byte</td></tr>
</table>

11.1.11 - HOMING COMMAND (A) (3 byte)

Used to command the homing procedure (axis reset). The Homing type and operating parameters are described in Chap. 8.6. This command is executed and confirmed with a reply only if F07 equals 3 (Motion commands from the serial connection).

ND (F18)	Command	Checksum
0 / 127	A	0 / 255
1 byte	1 byte	1 byte

REPLY TO COMMANDS WITHOUT ECHO
Command received correctly (3 byte)
Reply = Device number + O + K

REPLY TO COMMANDS WITH ECHO (10 byte)
The reply is identical to the telegram transmitted + the characters "O" and "K" in place of the checksum.

11.1.12 – POSITIONING COMMAND (T) (14 byte)

Used to execute a positioning with defined speed and altitude. Positioning can be absolute or relative. This command is executed and confirmed with a reply only if F07 equals 3 (Motion commands from the serial connection).

ND (F18)	Command	Positioning type	Speed	Target		Checksum
				Whole	Decimal	
0 / 127	T	A – Absolute R – Relative	0 / 6000	Variable depending on the position factor		0 / 255
1 byte	1 byte	1 byte	2 byte	4 byte	4 byte	1 byte

REPLY TO COMMANDS WITHOUT ECHO
Command received correctly (3 byte)
Reply = Device number + O + K

REPLY TO COMMANDS WITH ECHO (15 byte)
The reply is identical to the telegram transmitted + the characters "O" and "K" in place of the checksum.

11.1.13 – MOTION COMMAND (ON) (6 byte)

Used as a start command to control speed. This command is executed and confirmed with a reply only if F07 equals 3 (Motion commands from the serial connection).

ND (F18)	Command	Speed	Checksum
0 / 127	ON	-6000 / 6000	0 / 255
1 byte	2 byte	2 byte	1 byte

REPLY TO COMMANDS WITHOUT ECHO
Command received correctly (3 byte) Reply = Device number + O + K

REPLY TO COMMANDS WITH ECHO (7 byte)
The reply is identical to the telegram transmitted + the characters "O" and "K" in place of the checksum.

11.1.14 – STOP COMMAND (OF) (4 byte)

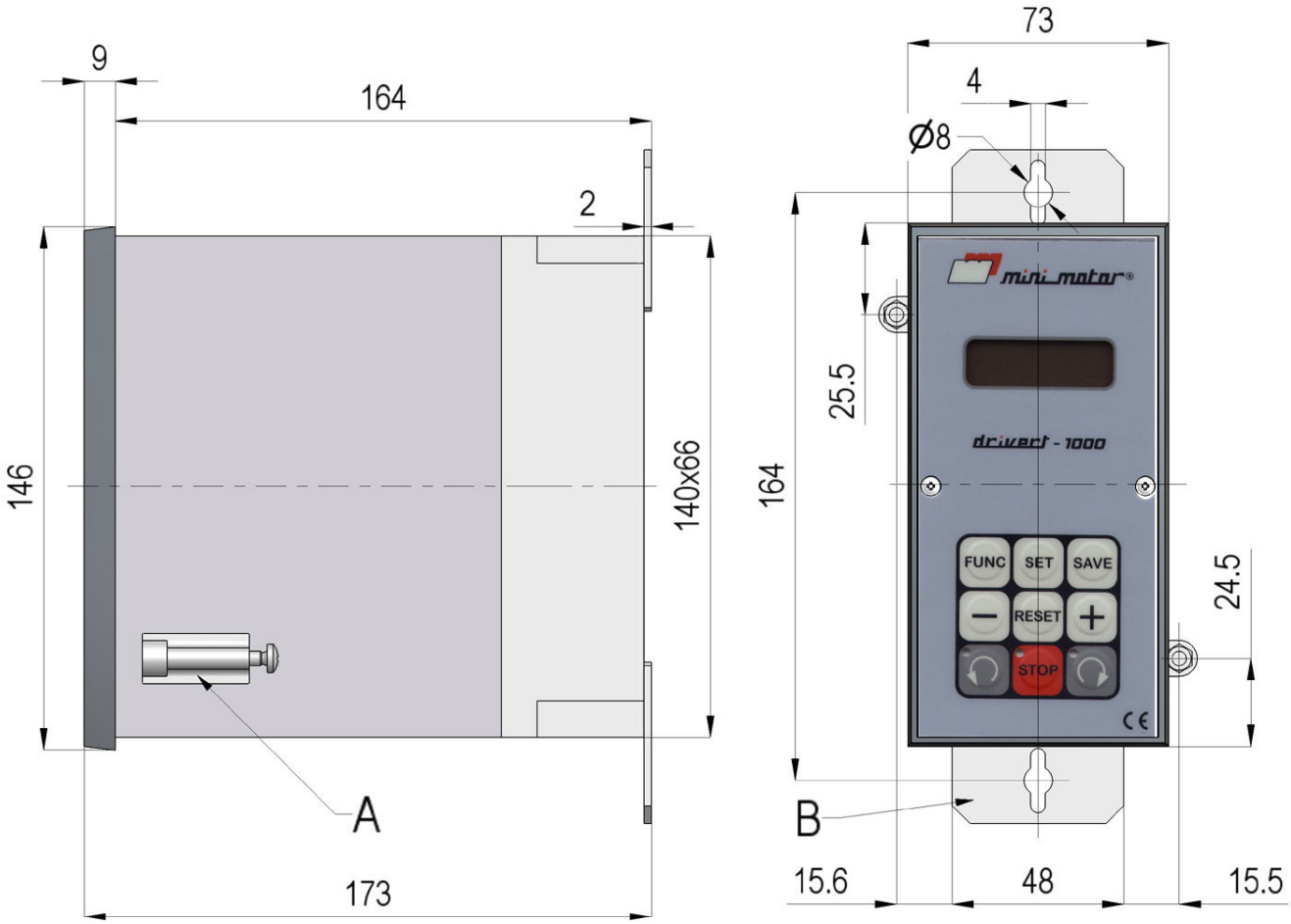
Used to disable the drive. This command is executed and confirmed with a reply only if F07 equals 3 (Motion commands from the serial connection).

ND (F18)	Command	Checksum
0 / 127	OF	0 / 255
1 byte	2 byte	1 byte

REPLY TO COMMANDS WITHOUT ECHO
Command received correctly (3 byte) Reply = Device number + O + K
Commands received correctly, but with values outside the limit, are not executed.

REPLY TO COMMANDS WITH ECHO (5 byte)
The reply is identical to the telegram transmitted + the characters "O" and "K" in place of the checksum.

12 – OVERALL DIMENSIONS



A) Elements for fixing to the panel
B) Brackets for fixing behind the panel/on the wall

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